The UNESCO Courier

A window open on the world

November 1967 (20th year) U.K.: 1/6-stg. Canada: 30 cents - France: 1 F

UNESCO ARCHIVES

U.S.S.R. TODAY

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ST. SIMEON AND THE SKYSCRAPER

Mantled in scaffolding and dwarfed by its multi-story neighbour, a 17th-century Moscow church undergoes restoration. Located near the Kalinin Prospect, a broad, modern avenue bisecting an area recently transformed by town planning, the church is preserved in its modern surroundings. It is dedicated to St. Simeon Stylites, propagator of the Greek Orthodox faith and one of Russia's most venerated saints. Two years ago a society for the preservation of historic and cultural monuments was set up in the Federal Republic of Russia, in the U.S.S.R. Some 30,000 monuments have since been catalogued and many of them are being restored.

The UNESCO Courier

NOVEMBER 1967
20TH YEAR

NOW PUBLISHED IN ELEVEN EDITIONS

English
French
Spanish
Russian
German
Arabic
U.S.A.
Japanese
Italian
Hindi
Tamil

Published monthly by UNESCO

The United Nations
Educational, Scientific
and Cultural Organization

Sales and Distribution Offices
Unesco, Place de Fontenoy, Paris-7e.

Annual subscription rates: 15/-stg.; $3.00 (Canada); 10 French francs or equivalent; 2 years: 27/-stg.; 18 F. Single copies 1/6-stg.; 30 cents; 1 F.

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The UNESCO COURIER is published monthly, except in August and September when it is bi-monthly (11 issues a year) in English, French, Spanish, Russian, German, Arabic, Japanese, Italian, Hindi and Tamil. In the United Kingdom it is distributed by H.M. Stationery Office, P.O. Box 569, London, S.E.I.

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The Unesco Courier is indexed monthly in The Readers' Guide to Periodical Literature, published by H. W. Wilson Co., New York.

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Cover photo

This young girl from Volgograd (formerly Stalingrad) typifies the present-day youth of the U.S.S.R. She is seen standing before the Komsomol monument dedicated to all the young men who died here during the famous battle of World War II in defence of the city. Reduced to rubble during the war, the city has now been completely rebuilt and modernized.

U.S.S.R. TODAY

Metamorphosis of a continent

by Nikolai Mikhaílov

Fifty years ago, the October Revolution of 1917 led to the creation of the U.S.S.R. — the Union of Soviet Socialist Republics. A major part of this issue of the UNESCO COURIER is devoted to developments in education, science and culture in the U.S.S.R. today.

No country on earth presents more diversity than the Soviet Union. Primarily this is due to the vastness of its territory: more than 22 million square kilometres (8,500,000 square miles).

From north to south the Soviet Union stretches for nearly 5,000 kilometres (3,000 miles). And from west to east still more: in the Soviet Pacific port of Vladivostok, at the end of the railway line running from Moscow, there stands a kilometre-post bearing the figure "9288" (6262 miles)—a distance to be found in no other single country in the world. This is almost equal to the distance from the pole to the equator. When dusk falls in Vladivostok, it is only dawn in Moscow. The New Year is rung in 11 times, since the Soviet Union is divided into 11 time zones.

In area the U.S.S.R. is the world's largest country. It could accommodate 700 Belgiums, for example.

Geographically, it would be more appropriate to compare the U.S.S.R. not to other countries but to continents: it is somewhat smaller than Africa, bigger than South America, three times as big as Australia. It can even bear cosmic comparisons: wherever you see the full moon in the sky, know that its visible face is smaller than the territory of the U.S.S.R.; one would have to add Argentina, say, to the moon's hemisphere to bring it up to the size of the Soviet Union.

In view of the vast size of the Soviet Union its extreme diversity should not surprise us.

It has mountain peaks reaching above the clouds and endless expanses of flat lowlands. The Great Russian (East European) Plain and the West Siberian Lowland stretch for thousands of miles. Among the highest mountains are the Pamirs, the Tien Shan, the Altai, the Caucasus. The highest peak in the U.S.S.R. (in the Pamirs) reaches to a height of 7,500 metres (24,600 feet).

The climate is equally diversified. There are places in Siberia that are colder in winter than the North Pole, and plains in Central Asia that are hotter in summer than the tropics. In Yahutia the winter temperature sometimes drops to minus 70°C, while in Turkmenia it is sometimes plus 70°C in the sun. In the Kara-Kum Desert in summer one can bake an egg in the sand, while in northern Siberia, during the winter polar nights the mercury solidifies in the thermometer and one can hear the crackling of the human breath as the vapour turns into ice crystals immediately. The Yahuts who live there call it the "whispering of the stars".

In Uzbekistan people begin mowing the barley, when the inhabitants of Petropavlovsk in Kamchatka are digging their houses out after another blizzard.

On the shores of the Barents Sea it takes a hundred years for a larch tree to grow slightly thicker than a ski stick, while in sub-tropical Ajaria on the Black Sea coast a young bamboo tree shoots up over a metre in one day.

The U.S.S.R. is skirted by twelve seas of the Atlantic, Pacific and Arctic oceans. The country has the largest network of rivers in the world, the world's largest lake—the Caspian Sea —as well as the world's deepest lake, the Baikal (1,620 metres or 5,315 feet at its deepest point).

The country is traversed by several soil-vegetation zones: in the extreme north there is a long bank of treeless, boggy tundra covered most of the year round by snow; the polar night there lasts several months, illuminated not by the rays of the sun but by the Aurora Borealis. To the south there is a forest belt, the world's most abundant concentration of coniferous trees. Further south the forests thin out and give way to the steppes; the steppe belt with its rich fertile soil stretches across the land for several thousand kilometres. Still further south the steppe turns into semi-deserts and deserts which serve for grazing. In those places where rivers run down into the desert zone from the southern mountains, there are irrigated oases—bright greenery against a yellow background. Finally, on the Black Sea coast and in the southern valleys of Central Asia, sheltered from the north by mountains, there are sub-tropical regions which hardly ever experience frost. There the sea never freezes, roses bloom in January, and even such heat-loving plants as the date palm bear fruit.

So the U.S.S.R. has plants that range from dwarf birches to palm, from lichens to lotus and animals that vary from the snowy owl to the flamingo, from the polar bear to the tiger.

An immense variety of raw products are industrially processed in the U.S.S.R. Industry has to deal with nearly all the elements in Mendeleyev's Periodic Table. Soviet power stations produce electric current from coal, coal

CONTINUED ON PAGE 6

NIKOLAI MIKHAILOV *the Soviet geographer and author has written widely on the countries he has visited in many parts of the world. A U.S.S.R. State Prize winner, he has devoted a number of books to the geography and evolution of the Soviet Union. An English translation of a recent work, "Discovering the Soviet Union", was published by Progress Publishers, Moscow, in 1965.*

Photo © Paul Almasy, Paris

Second largest city of the U.S.S.R., Leningrad has a population of over three million. Its construction was begun in 1703 by Peter the Great and from 1712 to 1918 (first as St. Petersburg and, during the First World War, as Petrograd) it was the capital of Russia. The Revolutions of February and October 1917 began in this city. The northernmost large city of the world (59 degrees N) it has been called "The Venice of the North" since it is built on over 100 islands formed by 66 rivers and canals and has 620 bridges. Photo shows rush hour on three-mile Nevsky Prospect, Leningrad's busiest thoroughfare.

Dusk falls in Vladivostok as day dawns in Moscow

dust, fuel oil, peat, combustible shales, natural gas; ever more power is being obtained from the energy of falling water (600,000 million kwh for 1967). And now a contribution is being made to the national economy by several large atomic power stations.

Factories throughout the country are smelting iron and steel, copper and nickel, lead and zinc, aluminium and magnesium, tungsten and molybdenum, and many other important metals. The U.S.S.R. produces machines of every complexity—from spaceships and gigantic walking excavators, each replacing 15,000 labourers, to instruments more sensitive than a human nerve.

The diversity of climate and soil allows a great variety of crops to be grown in the U.S.S.R.: rice, cotton, barley, tea and flax.

At present the U.S.S.R. has a population of about 240 million. Only China and India have bigger populations. The population is made up of many nations, large and small; it includes nationalities of various linguistic groups: Slavic, Turk, Finno-Ugrian, and others; the Russian population exceeds a hundred million, while in the Caucasus there is the Archi nation, all of whom live in a single settlement.

SOVIET children are taught in more than a hundred languages as different as are the histories of their individual speakers. In the Georgian language there are written monuments fifteen centuries old, while the Evenki (Tungus), who live in northern Siberia, have only acquired a written language since the Socialist Revolution of 1917, just as half a hundred other peoples of the U.S.S.R. who had no written language before. The inhabitants of the Soviet Union differ widely in appearance, the colour of their skin, their way of life, and in number of population (1).

But in essence they are all quite similar. In travelling across the U.S.S.R. one can see a Russian engineer dressed in a European-style suit, à Ukrainian peasant women in a traditional embroidered dress, an Uzbek in a vari-coloured robe, a Turkmen in a huge fur hat, a Caucasian highlander in a sheepskin coat, an inhabitant of the cold northland in furs. But whatever the region, all men and women share one common feature: absolute equality. Naturally, this makes for close ties and national unity.

The landscapes of the fifteen Republics, making up the Soviet Union, are all different. But the people from these widely differing areas all live under the same social and state structure.

This unit favours the rapid development of the country. Since all the basic riches belong to the state, the country is developing according to a single plan. In the output of major industry the U.S.S.R. has now surpassed Czarist Russia about seventy-fold. Industrial output has advanced from fourth place in Europe to first place.

Pre-revolutionary Russia provided 1/25th of the world's industrial production; now the U.S.S.R's share is nearly 1/5th, thus testifying to the country's extraordinary growth and change during the past half century.

THE Soviet Union has become one of the world's great powers, but this does not mean that all its problems have been solved. This country that was once extremely backward still has many unsatisfied needs and unrealized possibilities. The prospects for further increasing industrial and agricultural production are self-evident. These include, among other things, the exploitation of its enormous natural resources.

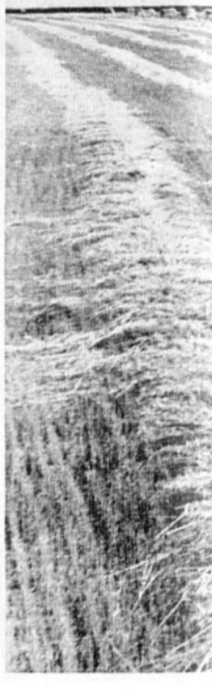
Essentially, the U.S.S.R. has all the useful minerals known on earth. It holds first place in the world in reserves of iron, manganese, copper, lead, and nickel ores, in potash salts, apatite (raw material for phosphorous fertilizers). The U.S.S.R. has an abundance of oil, gold, diamonds, uranium. It also leads the world in water-power resources.

One-third of all the world's forests are located in the U.S.S.R. and no other country can boast of such vast stretches of fertile, chernozem soil (black earth).

Much has already been done to exploit these resources and to raise the living standard of the people.

In the last decades, the economic geography of the Soviet Union has undergone great change and continues to change before our very eyes. The economic map has acquired a new look. It has become denser and more uniform.

Before 1917, Russia's industry was concentrated in a few isolated areas in the western part of the nation—in Moscow and its vicinity, St. Petersburg, the Donbass in the Ukraine, the Urals, the Caucasian Baku and the Baltic ports. Since then, it has spread throughout the land, providing each of the Soviet nations and each region with a basis for economic and cultural advancement and the utilization of virgin natural resources. The movement of industry eastward has been a continuing trend.



Top, supply plane comes in to land near a scientific research station in the Soviet Far North. Bottom, combine-harvesters at work in the fertile black-earth steppe zone that stretches for several thousand kilometres. The largest country in the world, the U.S.S.R. reaches from the Baltic to the Behring Straits and from the Arctic to Afghanistan. Washed by twelve seas of the Atlantic, Pacific and Arctic oceans, the Soviet Union has more rivers than any other country, the world's largest inland sea (the Caspian) and the world's deepest lake (Baikal). No less striking is its range of climates (from minus 70 degrees C. in parts of Siberia to plus 70 degrees in Central Asia).

The Donbass in the Ukraine, the nation's principal coal region, developed sharply, but its national share in coal output fell from nine-tenths to one-third because many other regions, especially in the east, began mining their own coal. Despite their growth, the giant oilfields of Baku fell behind new oil regions which sprang up between the Urals and the Volga. The Urals and the Kuzbass are now competing with the Ukraine in metallurgy.

One by one the rivers were deprived of their free and useless courses... on the Volga and the Dnieper this har-

(1) The U.S.S.R. is a multinational State. It comprises over 100 nationalities in 15 Soviet Republics, 20 autonomous Republics, 8 national regions and 10 national areas.

Photo © APN - D. Kozlov

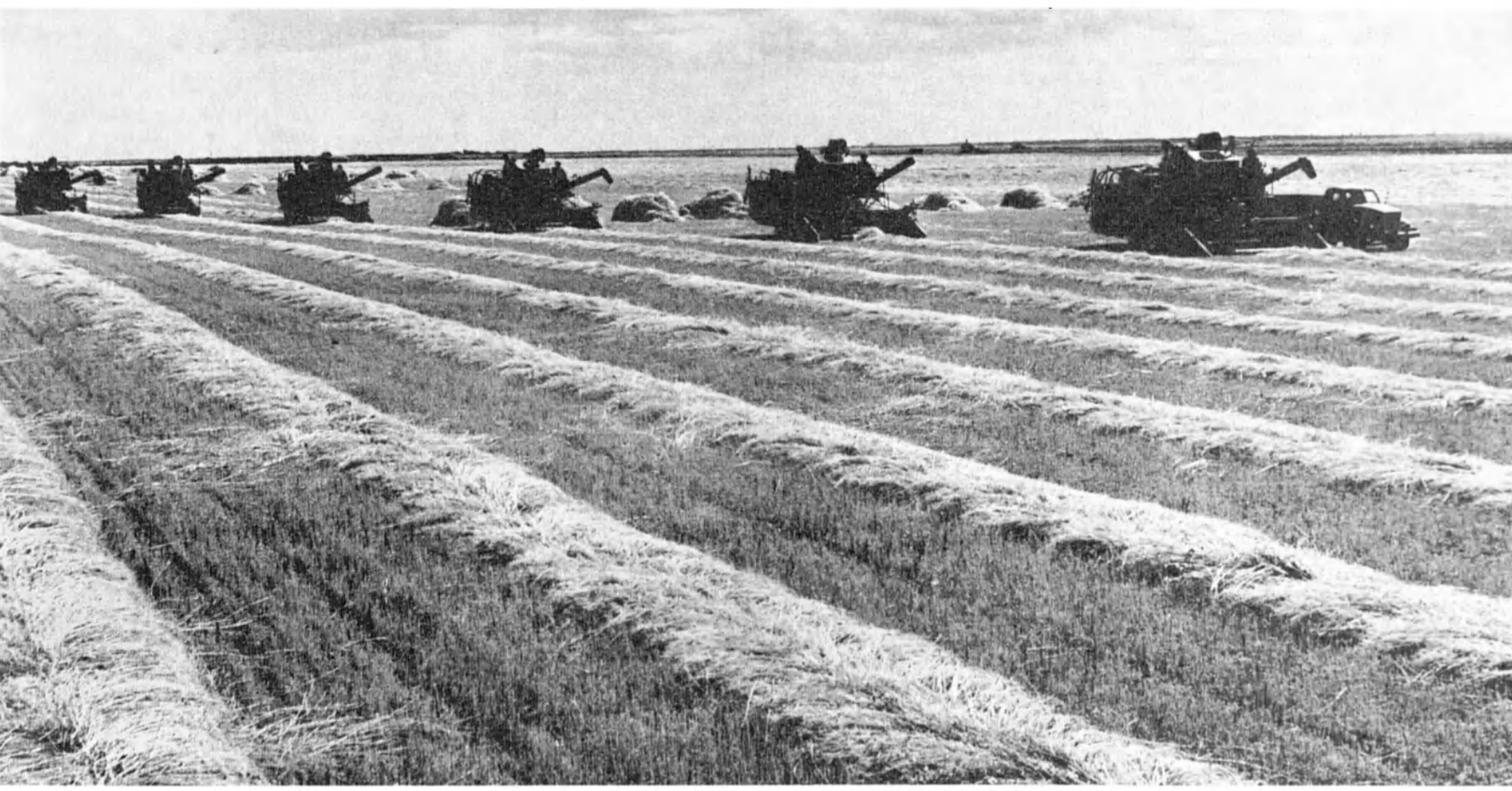


Photo © APN - I. Budnievich

nessing is nearing completion, while on the great Siberian rivers it is now getting into full swing, on a scale unheard of in world power engineering. Machines are no longer being produced in a few centres as in the past—we now can see automobiles made in Byelorussia and Georgia, tractors from the Urals and the Altai, lathes from Novosibirsk, and locomotives from Buryatia (beyond Lake Baikal). New meat, bread and clothes factories have sprung up everywhere. The solid foundations have been laid for a nationwide unified electrical power grid. Industry and industrial development have spread across the country. Siberia is a case in point.

In the past ten years this part of the country, equal in area to the whole of the United States, has witnessed fantastic transformations.

Siberia's economy is based on its colossal natural resources and power provided by cheap coal and rivers. Gigantic power stations are under construction and several are already in operation. For example, on the Angara River, in an ocean of forests, the world's largest hydroelectric power station, the Bratsk, has been built; and nearby the new town of Bratsk has grown up. Enormous enterprises are already operating there, such as the aluminium plant and the woodworking complex whose buildings extend for six kilometres. This year the first units of a still larger hydroelectric station, the Krasnoyarsk, on the Yenisei River is scheduled to go into operation with a total capacity of 6 million kilowatts. Construction has now begun on an even more powerful station, the Sayano-Shushensk, further north on the Siberian Yenisei River.

CONTINUED ON NEXT PAGE

Cities built on permafrost

It is calculated that energy from coal and rivers will turn Siberia into one of the world's greatest power centres. After all the power stations under construction go into operation, Siberia will be producing more electric power than any Western European country. And this is only the beginning.

The abundance of cheap power in Siberia is paving the way to the rapid expansion of industry. A number of aluminium plants are already operating in Siberia: one in Bratsk, another in Krasnoyarsk, one near Irkutsk and another in the Kuznetsk coal basin.

Iron and steel production is expanding. A large iron-and-steel plant was built in Novokuznetsk before World War II, and a second one since the war. In time, iron-and-steel plants will also be built in other parts of Siberia.

Metal provides a basis for heavy machine-building. The city of Novosibirsk on the Ob River, for example, now produces as many machines as did all of Russia before 1917. Krasnoyarsk on the Yenisei has turned into a major machine building centre, producing river boats, bridge cranes, self-propelled combines, refrigerators, washing machines, television sets and pianos.

RECENTLY one of the world's largest oil and gas basins was discovered in north-western Siberia, in the Tyumen region, in the lower reaches of the Ob River. It is already supplying oil and gas, and long pipelines, railways and a motor-road are being laid. By 1970 it will be producing as much oil as the whole of Azerbaijan, with its famous old oil centre Baku, did a year or two ago.

In Yakutia, located in the distant and formerly almost impenetrable taiga, rich diamond fields have been found and mining has already begun. Some of the diamonds are as much as 106 carats in size.

New cities are mushrooming in Siberia, and three-fourths of all the cities east of the Urals are new. Some of these cities, such as Norilsk, have grown up on permafrost, the buildings being erected on special reinforced concrete piles driven into the ice.

Maxim Gorky once wrote: "The fabulous scenes of a future Siberia stagger the imagination with their grandeur..." We are close to putting these words into effect.

A remarkable Science City has recently grown up in a pine forest near Novosibirsk, in the heart of Siberia. Here have been established 14 institutions of higher education, a scientific-technical library with 5 million books.

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Photo © APN - V. Tarasievich

GEOLOGISTS ON THE WING

Geologists are helping to change the economic geography of the U.S.S.R. Last year, 1,000 planes and helicopters airlifted Soviet geologists to prospection areas. Total length of geological probes and drilling was twice that of the earth's diamater at the equator. Top right, helicopter "taxi" for geologists lands on the tundra in the Chukotka region (Soviet Far East). In foreground are antlers of a reindeer herd. On landing (above) geological team sets off for weeks and even months of arduous work and camp life in virtually unexplored territories. Below, bearded geologist discusses day's ventures by candlelight. Siberia keeps engineers and statisticians hard at work revising the figures of its known wealth in oil, copper, diamonds, nickel, iron ore and other minerals.

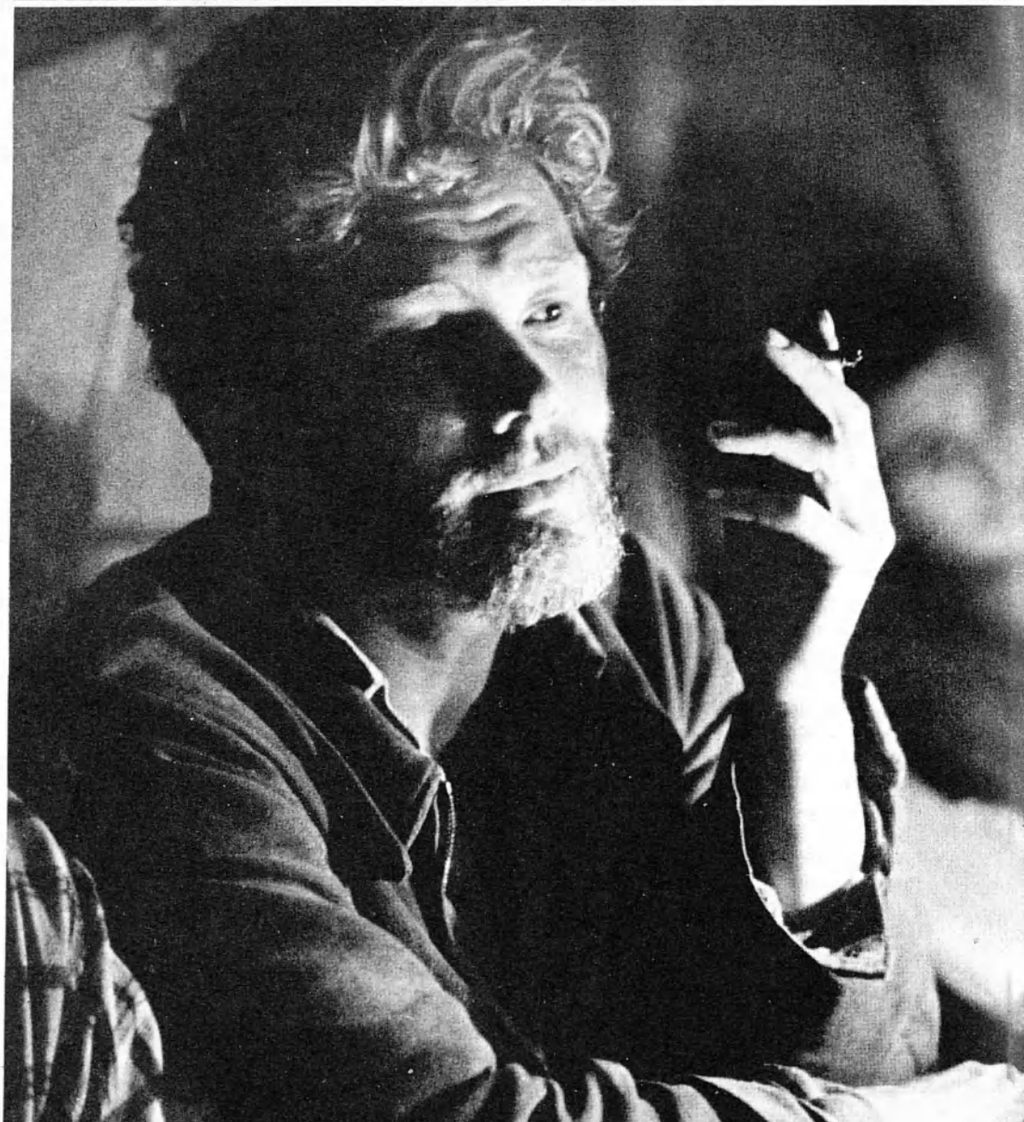
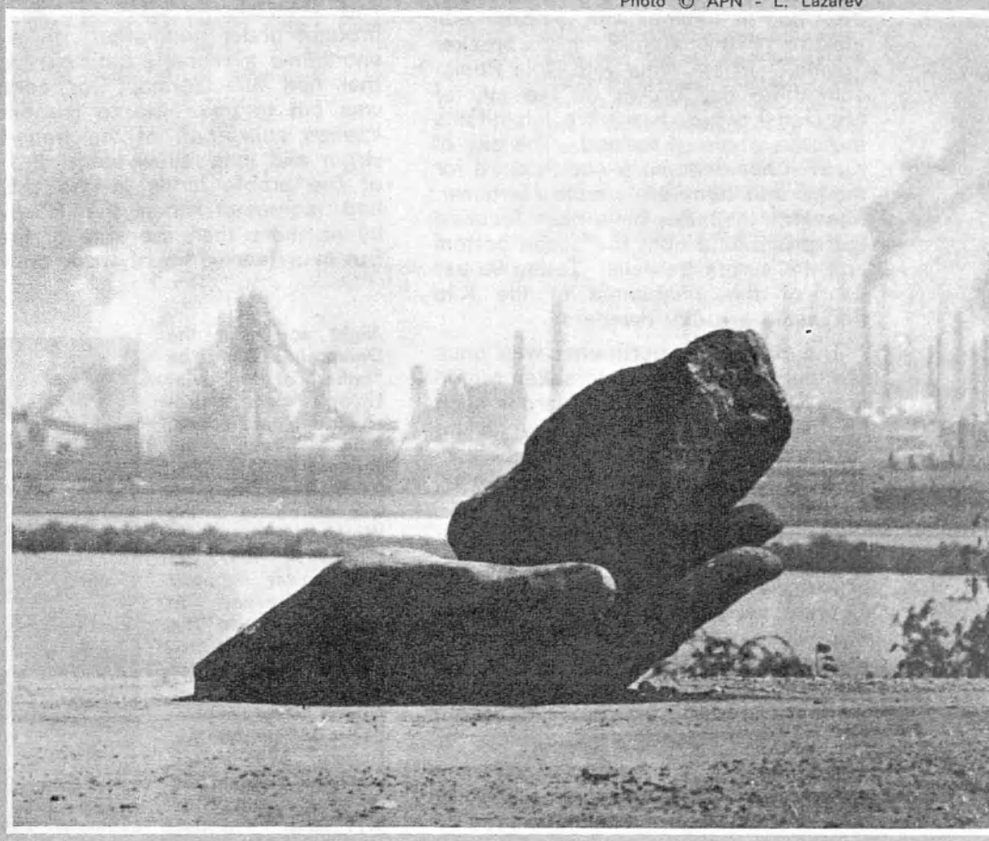


Photo © APN - D. Baltermantz

Photo © APN - L. Ustinov

Below, sculpture of a giant hand holding a lump of iron ore symbolizing Siberia's debt to nature which has endowed it with natural riches to match its size. In background are buildings of the immense steel production complex at Magnitogorsk in Western Siberia.

Photo © APN - L. Lazarev



The call of the Far North

A Siberian branch of the U.S.S.R. Academy of Sciences has been founded there with nearly a score of Academicians, two score corresponding members, and hundreds of scientific workers.

A simple enumeration of a few of the score of institutes there provides an idea of the scope of the work being done in this new scientific centre: a mathematics institute with its own computing centre, institutes of physics, thermal physics, non-organic chemistry, automation and electrometry, kinetics and combustion, hydrodynamics, economics and statistics, cytology and genetics. . .

The problems being studied include controlled thermonuclear reactions, the interior of the earth, cybernetics. The hydrodynamics institute has developed a water-cannon capable of disintegrating the very hardest rock. A high-speed electronic computer has been put to the unusual task of deciphering the hieroglyphics of the Maya Indians who lived many centuries ago in Central America. The average age of a scientist in the Siberian Branch of the U.S.S.R. Academy of Sciences in Novosibirsk is about 34 years.

ASTONISHING changes have also occurred in the development of the U.S.S.R.'s extreme North. Along the former impassable coastal waters skirting the north of Siberia there now operates a regular North Sea route, equipped in summer with ice-breakers, including the atomic ice breaker "Lenin." In the once wild Kola Peninsula there has grown up the city of Murmansk which has more inhabitants than the whole of Iceland. The city of Kirovsk has become a world centre for the production of apatite fertilizer. Research institutes have been founded that investigate both the ocean bottom and the aurora borealis. Today 90 per cent of the inhabitants of the Kila Peninsula are city dwellers.

The Soviet far north-east was once a wilder and even more forsaken region than Siberia. Today in the areas such as the Chukotka Peninsula beyond the Arctic Circle modern industrial enterprises have been built and an atomic power plant is under construction.

The same holds true for the far south of the U.S.S.R., where forty years ago practically the whole population was illiterate, while the only form of industry was the separation of seeds from cotton to facilitate shipping it to the centre of the country. Today each of the four Central Asian Republics boasts its own independent Academy of Sciences.

The new distribution of industry caused new lines of communication to spring up and, consequently changed the face of transportation.

Not only has the overall mileage of railways been doubled and other transportation between the capital and other districts been increased, but the whole country is now linked by a vast network of railways, motor-roads and waterways. The so-called Turksib (Turkestan-Siberian railway) now connects Central Asia with Siberia across thousands of miles of desert. The South-Siberian trunk line passes through an enormous zone from the Southern Urals to the Kuzbass and the Yenisei and beyond. The Volga Don Canal forms a water bridge between the Volga Valley and the Donbass. The Volga-Baltic Waterway provides cheap transportation from Leningrad and the north to the central regions of the country. As for the railways, nine out of every ten tons are no longer drawn by steam-engines but by electric or diesel locomotives.

The agricultural map of the country has also undergone remarkable changes.

With the adoption of co-operative methods and the mechanization of farming it has been possible to eliminate those shortcoming in the utilization of farm lands that were born of the backwardness of pre-revolutionary agriculture.

The economic map has reflected the rapid expansion of cultivation. The area of tilled land has increased everywhere, especially in the East, where a large area of the steppes beyond the Urals in northern Kazakhstan and southwestern Siberia has been brought under cultivation. In a very short time a valuable natural resource that had lain dormant for centuries was put to use. Up to the time of intense cultivation of the trans-Urals virgin and long-fallow lands, the area of the arable lands in the U.S.S.R. had increased since the Revolution by no more than the area of France. But in a few years of work on virgin and long-fallow lands the Soviet East acquired arable lands exceeding in area the whole of Italy.

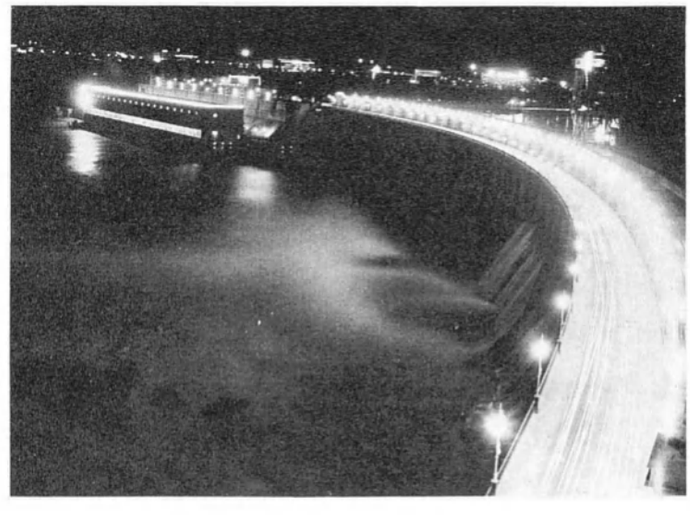
Not in all regions was the land ready for ploughing. In many places it first had to be prepared. In the hot south rivers had to be diverted to irrigate fields, and in the north bogs had to be drained and shrubs cleared away.

NOW nearly all the rivers of the far South have been brought under control in one way or another—from the modest Salgira in the Crimea to the Kura in Transcaucasia and the Syr-Dariya in Central Asia. The sun-parched deserts have been traversed by large irrigation canals, the length of the new Kara-Kum Canal in Turkmenia has already reached 800 kilomètres (500 miles). In many regions of the Byelorussian Polesie and the Georgian Kolkhida, swamps have been turned into fertile ploughlands. Farming oases have been created beyond the Arctic Circle. The slopes of the mountains skirting the Black Sea have become covered with plantations of subtropical plants.

To ensure steady and abundant harvests in semi-arid regions, a staggering measure is being put into effect: forest strips are being grown in the open steppes, changing the whole face of the region.

Important shifts have occurred in the distribution of crops in arable regions. Wheat has migrated further north into the non-chernozem zone, sugar beet has travelled from the Ukraine to the Far East, vegetable gardens have sprung up around cities, apple orchards have conquered the Urals and Siberia, where formerly there were none.

Such are some of the important changes in the economic geography of the U.S.S.R.



Night scene at the Dnieproges Dam, the "father" of the Soviet Union's giant hydro-electric installations, built across the Dnieper (1932). Over 2,500 feet long, it was destroyed during World War II. When rebuilt in 1947, its total power capacity was increased to 700,000 kilowatts. The colossal new hydro-electric installations in Siberia have even larger power capacities: Bratsk on the Angara (4,1 million kw) and Krasnoiarsk on the Yenisei (6 million kilowatts).

Photo © APN

Photo © APN

These Soviet girls are final year students at the teacher training college of Narian-Mar, chief town of the Nenets (Samoyedes) National Area which covers almost 180,000 sq. kms within the Arctic Circle. Fifty years ago this vast tundra was peopled almost entirely by nomad tribes of hunters and reindeer herdsmen who were totally illiterate. The Samoyede language had not even a written form. Today higher education is open to the children of yesterday's illiterates. The U.S.S.R. spends 18,700 million rubles (17.6 per cent of its annual budget) on education.

FROM ILLITERACY TO ASTRONAUTICS

by Viacheslav Elyutin

Half a century ago when our country entered on its new life, the entire population—men and women, workers and peasants, Russians and Ukrainians, Kazakhs and Uzbeks, Nentsi and Azerbaijanians—from the age of eight years upwards had to learn to read and write. Millions of citizens were taking their place in the central, national and local administrative organizations of the country, and the national economy, ruined by imperialist and civil wars, had to be set back on its feet.

In 1913, Czarist Russia accounted for a little over 4 per cent of the world's industrial production, and in 1920 this percentage was further decreased by the slump resulting from these conflicts. The country's agriculture had also suffered heavily.

Contemporary statistics show that at the beginning of 1917, 30 per cent of the country's population was illiterate, while among women, illiteracy reached 88 per cent. The local populations of the lands surrounding Czarist Russia, Central Asia in particular, were likewise almost totally illiterate: only 5 per cent of Tadzhiks, 6 per cent of Kirghizians, and 7 per cent of Turkmenians could read. Only 1,400,000 out of the 165 million inhabitants in the whole of Czarist Russia had received any education above the primary school level. In short, the Czarist regime bequeathed us a burdensome legacy in national education.

In 1919, the People's Commissariat (or Ministry) of Public Education in the U.S.S.R. described the level of technical knowledge in the new Soviet country as follows: "The number of

CONTINUED ON PAGE 13

VIACHESLAV ELYUTIN *is Minister for Higher Education and Secondary Technical Education in the U.S.S.R. A Corresponding Member of the U.S.S.R. Academy of Sciences, he has written many studies on educational questions and has been awarded a U.S.S.R. State Prize.*

Time for study, time for play

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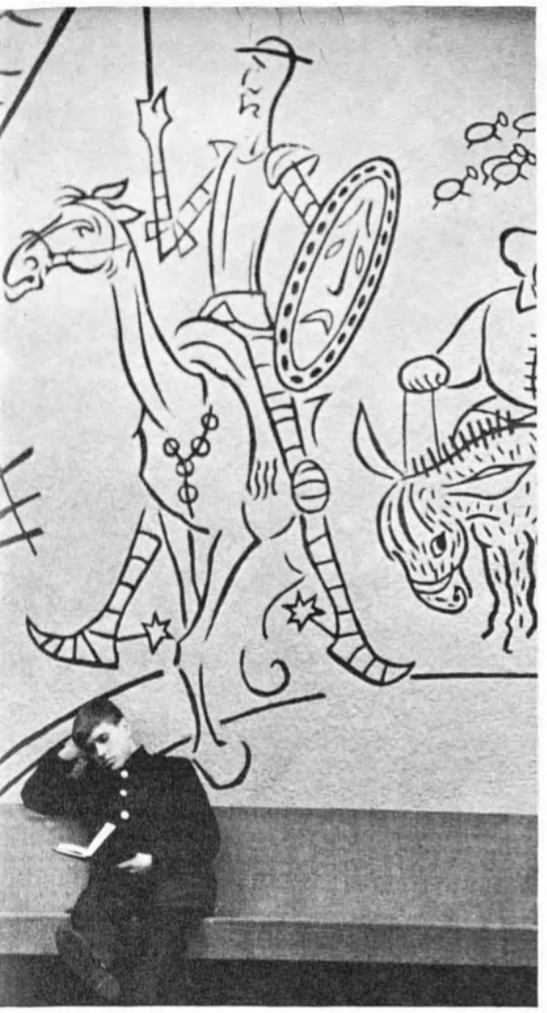
One person in three a student



In the Soviet Union one person in three studies (not taking into account children in nursery schools). Programmes and teaching methods are being increasingly adapted to the needs of modern scientific development, and the length of compulsory schooling has been increased. Above left, time off between lessons for some high spirited boys and girls in a primary school (all Soviet schools are co-educational). In certain schools, from the first year children are given a specialized education appropriate to their needs and aptitudes. Left, games with equations are child's-play for a rising generation of young mathematicans taking their recreation break. Below, this little girl from Tadjikstan, in Soviet Central Asia, is already learning to read in English. Common denominator of all these youngsters is their passion for books (annual book production in the U.S.S.R. has now reached 1,250 million). Above, behind a young reader in Moscow Pioneers Youth Club, the familiar figure of Don Quixote appropriately symbolizes the quest for adventure.

Photo © V. Chustov - M. Alpert

engineers in our country is negligible... Desperately insufficient too are the numbers of those with a secondary technical education... The general level of technical knowledge in Russia is low..."

Knowledge... the nation needed it urgently, and people in every part of the country aspired to greater learning. Emergent countries today are undergoing a similar experience, with this single exception, that in the case of the Soviet Union there was no outside aid. Nor was there, at that time, any international organization such as Unesco which could have given help in teaching. On the other hand, Soviet Russia had a nucleus of *avant-garde* intellectuals, young students, who though not very numerous, were full of enthusiasm and ready to give their energy, their time and their skill to the cause of mass education. The schools were open to everybody.

The new students who flocked to the institutes and to the universities were yesterday's workers and peasants, with their children. Few of them had the necessary education. So, on the initiative of the workers of Moscow, "workers' faculties" were created, where adults who already had considerable experience of life could learn the rudiments of the subjects required for admission to institutions of higher education. Workers' faculties were a temporary expedient, but, given the conditions of the time, they amply justified their creation. Now, with the growth and improvement of secondary education in the U.S.S.R. they are no longer needed.

Many present-day directors of industrial and other installations as well, and many Soviet scholars of note, began their training in the workers' faculties.

One of them is Professor Evgeni Tovstykh, Rector of the Institute of Naval Construction in Leningrad. The son of a workman, he started work himself at 15. From 1926 to 1929, he was sent by Komsomol to study at the workers' faculty of Nikolaiev, and thereafter, from 1929 to 1933, he attended the Institute of Naval Construction in the same town. Once qualified as an engineer, Tovstykh, though beginning only as a foreman, climbed the ladder of promotion to become director of some of the biggest shipyards in the country, including the Baltic Factory of Leningrad. Since 1945 he has been head of the Institute of Naval Construction in Leningrad. He is not only an outstanding scholar and professor but also an active and militant social worker.

The right of the citizen to be educated is laid down by the Constitution of the U.S.S.R. It is guaranteed by eight years of compulsory schooling and by the constant expansion of facilities for general secondary, vocational technical, specialized secondary and higher education, which the State encourages. In the U.S.S.R. all forms of education are free. Most students, and specialized secondary school pupils, too, have grants and free lodging.

Since the Soviets first came to power, the schools in the Soviet Union have trained close on 7 million specialists who have had a higher education and more than 11 million with secondary qualifications. During the seven-year period from 1958 to 1965 alone, more than 5 million specialists, including 2,412,000 with higher education, were trained in accordance with the plan for the development of the national economy.

AT the beginning of 1967, the Soviet economy was employing 1,800,000 engineers, over 3 million technicians, 320,000 specialists in rural economics who had received higher education, and approximately 500,000 who had had specialized secondary instruction, 554,000 doctors, nearly 2 million teachers with higher educational qualifications and 1,300,000 with specialized secondary qualifications.

It should be observed that among the Soviet specialists who have had a higher education there are 2,518,000 women (52 per cent). Among those who have a specialized secondary education, there are more than 4,400,000 women representing 62 per cent of the total number of specialists.

From 1940 to 1966, the vocational training schools trained nearly 17 million skilled workers for different trades.

During the scholastic year 1966-1967, the number of Soviet citizens pursuing studies of one kind or another amounted to 72 million, 48 million of whom were pupils in schools of general education. Today the U.S.S.R. boasts 767 universities and institutes (or seven times as many as in Czarist Russia) with 4,120,000 students (34 times the number under the old régime), and approximately 4,000 technical schools, with 4 million students.

Institutions of higher education in the U.S.S.R. are of two kinds: institutes and universities. The institutes provide a four to six-year course and train engineers, agronomists, doctors, teachers, economists, jurists and other specialized practitioners. Such institutes are to be found today, as are universities, in all 15 of the federated republics of our country.

In 1967, 900,000 new students entered institutions of higher education, 405,000 of whom attended day classes, the rest going to evening classes or taking correspondence courses. Students in faculties and institutes who

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Special privileges for evening students

attend evening classes or take correspondence courses enjoy various privileges at their places of work. For exemple, they can obtain a maximum of 40 days' supplementary leave per year for laboratory work, tests and examinations, as well as paid leave during the last year of study, of four months for students at higher educational establishments and of two months for pupils at specialized secondary schools, to enable them to prepare and present their diploma projects.

Courses of study in colleges and other institutions of higher education are divided as follows: in advanced technical colleges almost half the time is spent on general subjects (social sciences, higher mathematics, physics, chemistry, a foreign language, etc.), 25 per cent is devoted to general technical instruction (stress-resistance of materials, interchangeability of machine parts, theory of mechanics and machine design, electro-technology, hydraulics, etc.) and 25 per cent to 30 per cent to special subjects. Practical work occupies nearly 25 per cent of the total study time and experience has shown that, provided the student has a sound general training in the theory of each subject, this is quite ample.

It should be noted that colleges and universities have not given enough attention to the importance of practical scientific work as opposed to theoretical training. In the last few years, however, contacts with industry and agriculture have been developed for this purpose to a noteworthy extent. At the request of industrial concerns, co-operative farms (kolkhozes), state-farms (sovkhozes) and various economic bodies, student clubs and societies now study the operating efficiency of industrial and agricultural installations and then draw up plans for machines and machine-tools, survey the subsoil and study demographic problems for future scientific development.

As an instance of this, the students of the Institute of Civil Engineering in Moscow have prepared a project for an experimental town in the Polar regions, and a project for an embankment involving improvement of the area adjoining the reservoir in the town of Ijevsk, in the Ural region. The students of the Institute of Architecture in Moscow have drawn up a plan for the reconstruction of the industrial sector of Ivanovo, north-east of the capital.

The rapid increase in our scientific knowledge (specialists consider that the quantity of scientific information in the world is doubled every ten years) coupled with the relatively short time that can be devoted to education demands constant improvement of study methods. Films, radio, television and computers are being called upon more and more often to supplement traditional methods of teaching. The study of the problems of programmed learning in the U.S.S.R. is of relatively recent date, but positive experience has already been acquired in this field.

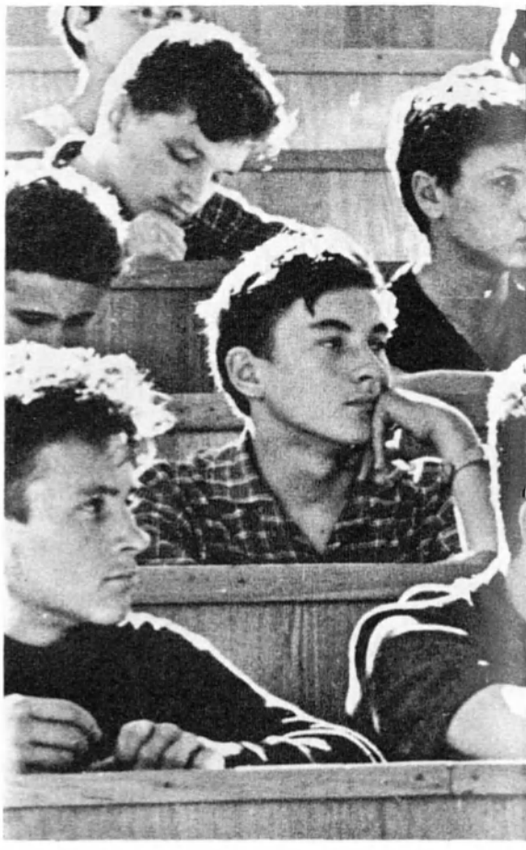
In collaboration with specialists in education, psychology, cybernetics and mathematical logic, scientists and students at our institutes have invented many varied teaching and testing devices.

From year to year an ever-increasing number of young people come from abroad to study in the U.S.S.R. In Soviet institutes there are many young Asians, Africans and Latin Americans. At present there are more than 24,000 foreigners from 130 different countries in nearly 300 schools in the U.S.S.R.; over 10,000 of these come from Asian, African and Latin American countries.

Among the Soviet institutions of higher education which train high-ranking staff for the Asian, African and Latin American nations, the Patrice Lumumba Peoples' Friendship University, founded in 1960, plays an important rôle. Close on a thousand young engineers, agronomists, mathematicians, physicists, jurists, philologists and economists have already completed their studies at this university and, specialists now in their field, have returned to their own countries.

Apart from training foreign specialists in Soviet colleges the U.S.S.R. is co-operating on the technical side in the foundation of study centres in developing countries. With Soviet aid, 22 centres have been or are being built in Burma, India, Indonesia, Ethiopia, Cambodia, Guinea, Mali, Algeria, Kenya, Afghanistan, Tunisia and elsewhere. Soviet establishments of higher education help in working out plans for teaching methods and send textbooks, specialist publications and scientific and technical information for these study centres. Hundreds of Soviet teachers are working there too.

The most important task of higher and specialized secondary establishments is to improve the training and education of specialists with due regard for the requirements of contemporary production, science, technology and culture and the possibilities for their future development. To this end, scientific groups have worked out means of determining the scope and the content not only of each branch of instruction but also of each subject. This will be a sound guarantee of further successes in the development of higher and specialized secondary education in the Soviet Union.



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Facing the of modern

by Mikhail Prokofiev

The education of the rising generation has long been a subject of analysis and criticism in learned journals and the popular press, at gatherings and at conferences. It has been examined from various angles and at various depths, and we now see more clearly our strong points and weak points and the ways in which we can improve public education.

We are now convinced, for one thing, that when the secondary schools in the U.S.S.R. attempt to give vocational training the result is a lowering of scholastic standards, with less attention paid to the main subjects.

It has also become obvious that the

MIKHAIL PROKOFIEV *is Minister of Education in the U.S.S.R. A Corresponding Member of the U.S.S.R. Academy of Sciences, Professor Prokofiev teaches at the University of Moscow. He has written extensively on problems of university education, educational administration in the U.S.S.R. and the admission of technicians to higher studies.*

Students in this class belong to a new generation of scientists and mathematicians being formed in the special science training centres of the U.S.S.R. In Siberia, students qualify for places in these specialized schools by entering a Science Olympics competition designed to select the most naturally gifted young people throughout the region.

complexities education

scope, methods and programmes of instruction have to be re-examined.

In a period of rapid scientific and technological progress, a period of what is called the "information explosion," the teaching of many school subjects has remained unchanged or, even worse, the old subject-matter has been patched up with new and fashionable views that give a semblance of bridging the gap between out-dated material and contemporary knowledge. Formal methods of instruction, with too much stress on memorizing, have become widespread.

Fifty years ago the main job for our country was to liquidate illiteracy. When that was accomplished we introduced universal elementary schooling, then a compulsory seven-year education for all children, and now universal eight-year schooling.

We are now on the threshold of universal secondary education for young people.

Two or three years ago we were telling teen-agers: you've finished eight years of school; now get a job and repay the nation for what it spent to educate you. Now we tell them: modern development requires that you possess higher education or qualifications. Greater knowledge will give you more versatility and your life will be more interesting. Society will appreciate you more if you stay on in school until you complete a general secondary education or, if you prefer, enter a specialized secondary school or a vocational school where you can learn a good trade and professional skills.

This approach seems simple but it is not so easy to put it into practice. Nothing is ever accomplished mechanically in education. Planning and facilities may be ideal, but education will have an influence on society only if we carry out painstaking, individual work with the teachers, the pupils and the parents.

It is becoming more and more imperative that each member of the rising generation should be given a thorough secondary education. We intend, within the next few years, to draw all boys and girls into secondary school education in one form or another.

What are these forms? First, a ten-year general secondary education offering courses in all subjects but providing a good knowledge of the fundamentals of science sufficient for admission to college or university. We estimate that from 70 to 75 per cent of the young people will choose this road.

Secondly, young people may choose, after finishing eight years of school, to enter a technical secondary school where, in three or four years, they receive a general education and learn a trade or skill that will enable them to get medium-level specialized jobs.

These two forms, we believe, plus evening schools and study by correspondence, will enable us to give all young people a secondary education. There are many problems, including the adolescent's possible lack of desire to

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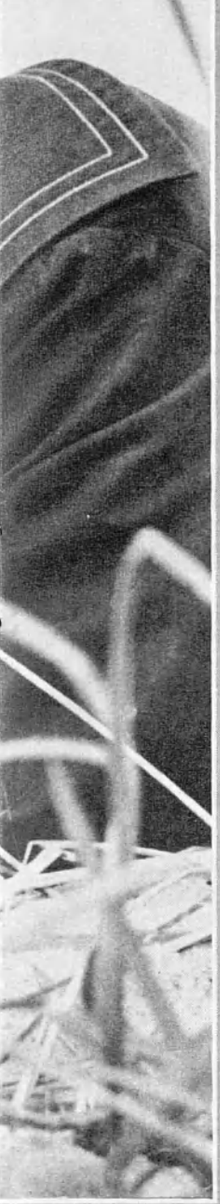
Photo © APN - N. Sviridova

SOVIET YOUTH 1967

Photo © APN - V. Tarasievich

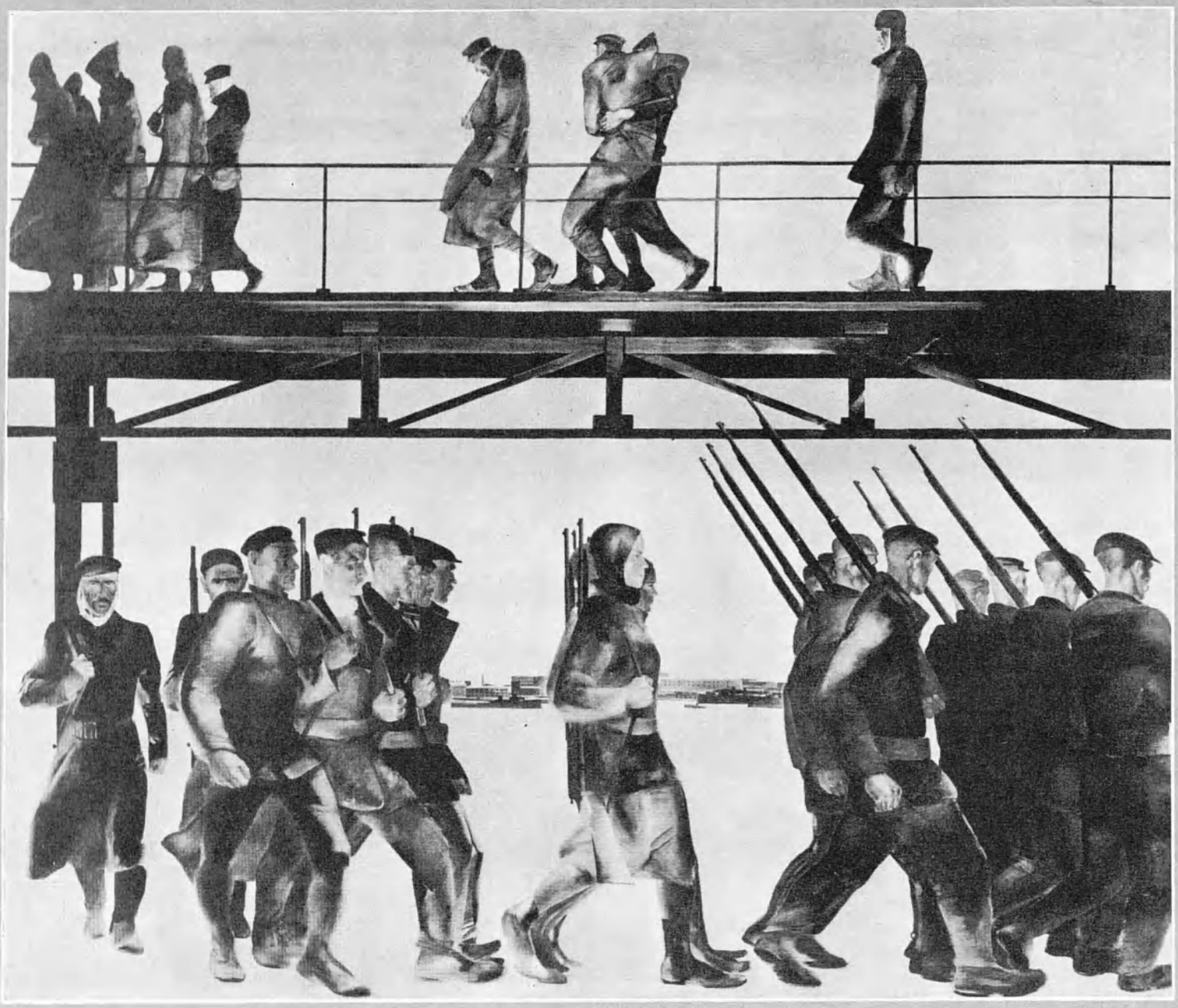
Norilsk, in the Taimyr National Area of northern U.S.S.R., has been called "a city unlike any other". It is built on permafrost, eternally frozen ground, and around it are huge wooden shields to hold off mountains of snow. It is also a city of youth—average age of its citizens is 25. Heated swimming pools are another feature of Norilsk which ranks first in the U.S.S.R. for per capita consumption of hot water. Above, children splash in a kindergarten pool. Right, Leningrad Youth Club offers concerts, lectures and jazz sessions, and its buffet is a convivial centre for relaxation and lively conversation.



The Soviet Union today is the scene of tremendous changes—at the forefront of which young people are playing a leading role. Below, two youngsters direct tree-felling operations in the immense forest region of Arkhangelsk in the Soviet Far North. Girl is a skilled forestry expert; young man is her assistant. Photo left, like all young people, Soviet youth is preoccupied with its dreams, hopes and plans for tomorrow.

Photo © APN - V. Tarasievich

Photo © Paul Almasy, Paris



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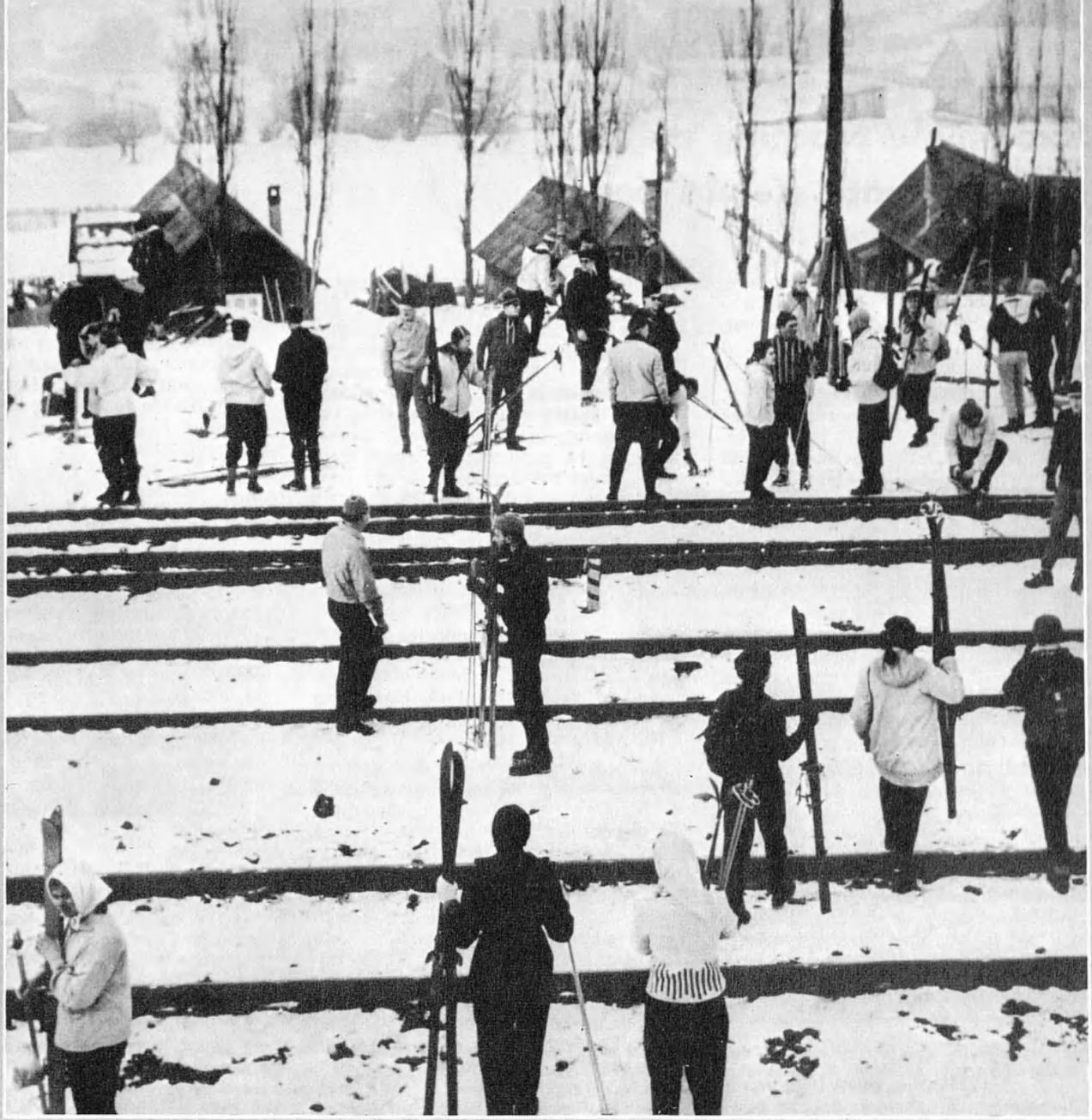

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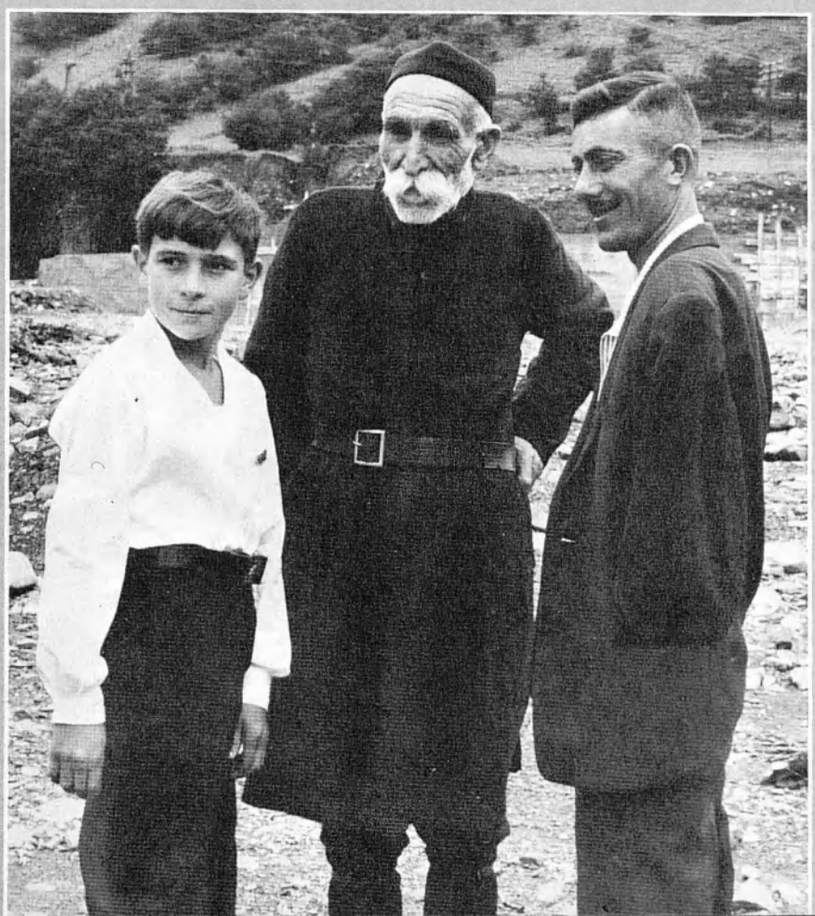


Photo © Paul Almasy, Paris

From one generation to another

1 "The Defence of Petrograd", a famous work painted by Alexander Deineka in 1928. In its mood and tone, the picture is keyed to the spirit which animated the Russian people at the time when the new political and social regime was established.

2 Animated scene at a Ukrainian winter sports centre as a crowd of young skiers arrives for a day's sport.

3 Young Kiev girl at work in a factory producing high precision electrical equipment.

4 Three generation meet at Maharadze (Georgian Republic). With the grandfather, a veteran farmer, are his son, disabled in the Second World War, and grandson, a secondary school student, preparing for a scientific career.

 (Continued from page 15)

Streamline teaching methods and eliminate stereotypes

continue his studies. Only by working in close contact with each family and each teen-ager will we be able to attain the truly unprecedented goal of a secondary education for all.

To do this we shall have to open, equip and staff 8,000 new secondary schools this year and in 1968. The main lines along which instruction is to develop have been mapped out. We realize that everything cannot be changed all at once and intend to improve the school curriculum gradually and persistently.

A new pattern of study hours is being introduced to relieve the excessive load the pupils now carry; there will be 24 hours of compulsory classes a week in the junior grades and 30 hours in the senior grades. Doctors and physiologists agree this is more or less the optimal pattern.

To this we add a programme of optional subjects to meet the interests and inclinations of the individual pupil. Elective courses must be particularly well-thought-out. Experts will be invited to conduct them. A mediocre teacher will never be able to make an elective course stimulating. It degenerates into idle talk or a repetition of previous lessons.

OVER the past few years a huge team of scholars, college educators, methodologists and schoolteachers has painstakingly analyzed, re-examined and, in the main, approved new syllabuses. The main idea has been to avoid overloading the pupil's memory with facts. Instead, the basic laws governing the development of the material world and social processes will be studied from the standpoint of our contemporary understanding of them.

In the biological sciences the pupils will, of course, gain a picture of the great variety of forms of life, from the virus to the human being. However, the important thing is not to memorize the names of the countless species, families, etc., but to grasp the basic laws governing the functions of the living organism. This is what the course in general biology now included in the syllabus sets out to do, but so far it is making slow headway in the schools.

In chemistry the pupils will have to learn about a great number of both natural and synthesized substances. Their efforts will be rewarded by an understanding of the laws governing the formation of chemical substances, presented in up-to-date, comprehensible form in the courses provided in organic and inorganic chemistry.

The course in the literature of the peoples of the Soviet Union and other nations naturally cannot encompass everything. Not even specialized college courses can. The secondary school literature programme aims not at "covering" a work of fiction but at teaching the pupil to think about it, to think about the social facts and conditions and moral principles it deals with, discern the beauty of the imagery, and develop a taste for reading.

Methods of instruction must be activized and individualized, stripped of the stereotypes that sometimes result from strictly following set teaching methods supposedly suitable for all occasions. We believe that the closer instruction comes to the principle that "learning is an act of discovery" the more successful it will be.

Laboratory experiments and demonstrations are not always meant merely to confirm the generally accepted laws recorded in the textbooks. More often they are a study of laws and an observation of facts that have to be understood and explained—a process by which the experienced teacher leads his pupils up to the discovery of a law. In the final analysis, it is development of methods of instruction that make the pupil realize science is not something complete and unchanging but is an ever deeper penetration into the sphere of the unknown.

That, roughly, is the line reconstruction of the curriculum and the syllabuses is now taking. It presupposes, naturally, the installation and provision of laboratories, study rooms, good textbooks and manuals, teaching aids which include technical equipment and machines for programmed instruction, and many other items.

TODAY'S younger generation is living in a fortunate period. Human genius has penetrated deeply into the essence of social phenomena, which man is using to remake the world in the name of human happiness. Human genius is delving deeply into the secrets of the universe and the essence of matter. Man has gone out into space and is sending probes to distant planets. He has discovered a new form of energy, nuclear energy. He is investigating living phenomena and is, as yet timidly, changing their lower forms. Progress is only a matter of time.

A generation is growing up of inquiring, active young people inspired by the great ideals of transforming the world into a satisfying place for everyone. And the schools are doing their best to educate a new generation of young people imbued with an optimistic outlook.

Photo © Paul Almasy, Paris

The Soviet Union has now more than 760 universities and institutes of higher education with over four million students. In science alone, the U.S.S.R. has more than 700,000 qualified men and women. Here, young scientists at a Soviet institute meet colleagues from abroad.

Photo © Paul Almasy, Paris

Twinkling lights in the fading glow of sunset give a fairy-like air to this remarkable photograph of Red Square, Moscow. The square and the wall and towers of the Kremlin (on left) are symbols of Moscow familiar even to those who have never been there. With its churches, palaces and nearly one and a half miles of encircling walls, the Kremlin is the ancient historical, cultural and architectural centre of Moscow as well as the seat of government in the U.S.S.R. Silhouetted in background is Moscow's historical museum. In 1947, Moscow celebrated its 800th anniversary.

REFLECTIONS ON SOVIET CULTURE

by Sergei Gerasimov

EACH of us who lives in the twentieth century, even if endowed with a very ordinary memory, preserves an infinite number of images and ideas that are contradictory, involved, tragic and splendid, for the twentieth century has compressed events upheavals and discoveries with an energy hitherto unknown in history.

The term "culture" if we leave aside the dictionary definition, includes a great number of concepts and ideas and is interpreted in many different ways by different people. Still, man is inclined to see in this word his supreme possession, that which remains to him as a reward for all his work, sufferings and searchings, that which is handed down from generation to generation with the spontaneous and lofty purpose of improving the human race.

The materialist view on life does not, however, claim this process must be naively straight-forward, each successive advance making progress easier. The advance, grim and complicated, brings mankind up against bitterly brutal conflicts and contradictions, including tragedies such as the two world wars, especially the second, which took a toll of tens of millions of lives.

Nevertheless, the advance continues, gaining more and more momentum. To us who are trying to build a socialist society it is an enormous help to realize that we are doing it for all men.

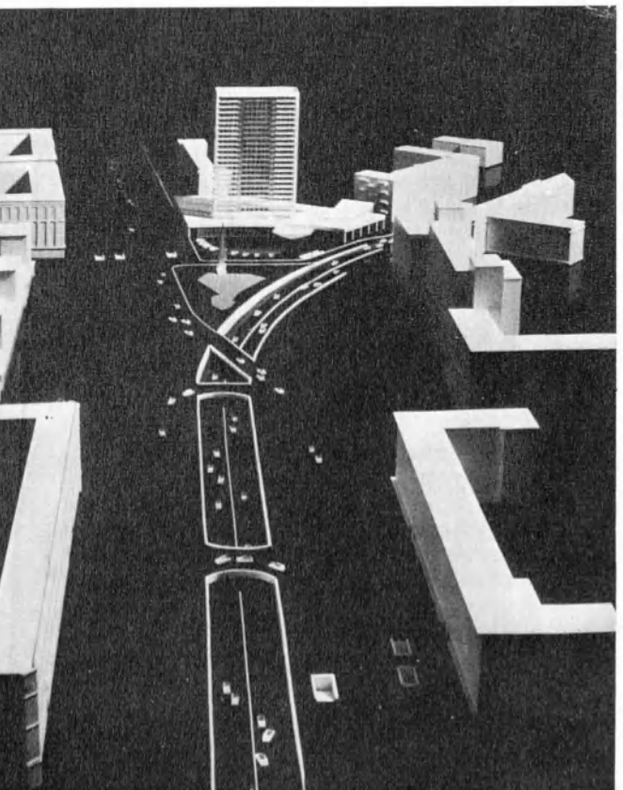
It so happens that I have devoted

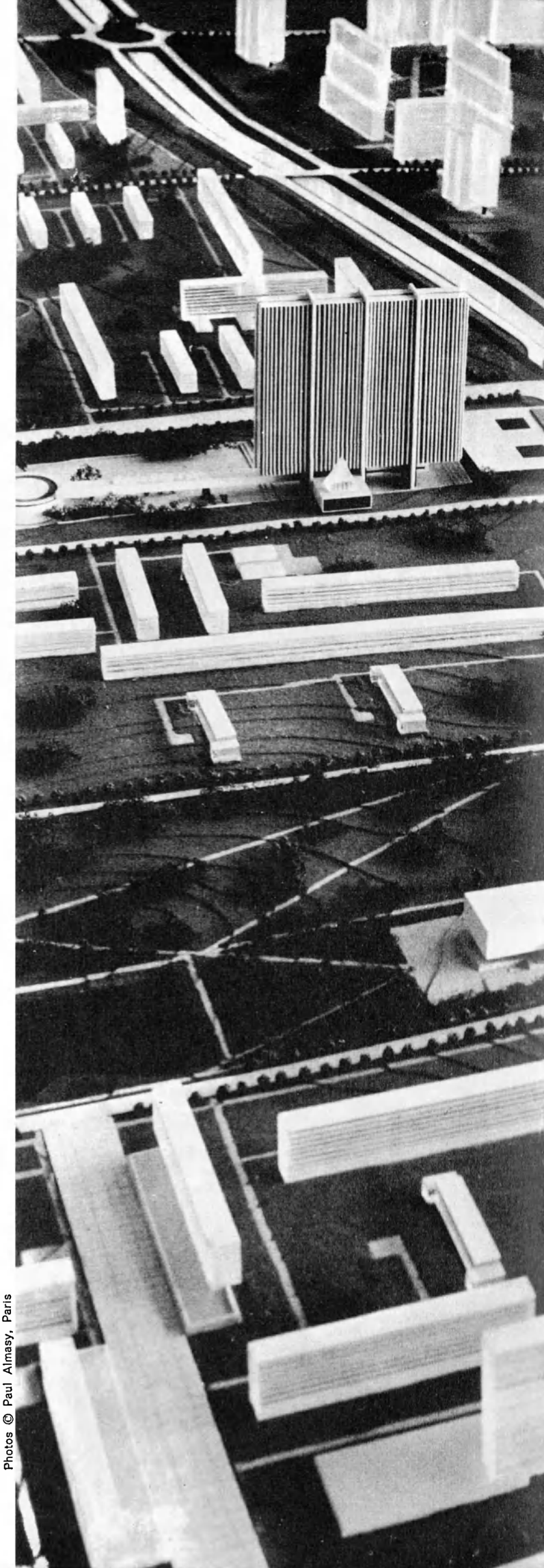
CONTINUED ON PAGE 27

SERGEI GERASIMOV *has had a distinguished career as a film director and as an actor. Many of his films have gained awards at Soviet and international film festivals. A recent production, "The Journalist," for which he also wrote the script, was awarded first prize at the 1967 Moscow Film Festival. Sergei Gerasimov, who is a People's Artist of the U.S.S.R., directed "The Silent Don", a film based on the famous novel by Mikhail Sholokhov.*

NEW HORIZONS IN MOSCOW

Moscow, capital of the U.S.S.R., is a swiftly growing metropolis. Greater Moscow counts some five million inhabitants and in the built-up areas that have risen along the main highways from the city, live three million more. New plans for urban development aim to link up these suburban population centres and to create a number of modern cities on the outskirts of Moscow. Right, architectural model of one of these cities, now under construction. Its designers give high priority to the need for greenery and open spaces. Above, "master architects" of the new Moscow: Mikhail Posokhin (on left) is Minister of Urban Development in the U.S.S.R. and President of the Government Commission for Construction and Architecture. He was the chief designer of the Palace of the Congresses built within the Kremlin in 1961 (see page 26). With him is Mikhail Perchine, Chief Architect for Urban Development Planning. Below, model of a new development area, today completed, along the length of the Leningrad Prospect—main highway from the city to the Sheremetyevo International Airport.





Photos © Paul Almasy, Paris

NEW HORIZONS IN MOSCOW *(Continued)*

Below, scale models of buildings on this architectural layout of central Moscow reveal outlines of the new metropolis now rising under a master plan for the Soviet capital's development up to 1980. New Moscow landmarks on model are multi-story buildings on the Kalinin Prospect (1) and Moscow's latest and largest hotel, the Rossiya (2). Between them is triangular-shaped outline of city's oldest landmark, the Kremlin, its southern wall rising above a bend in the Moskva River. Bottom centre, another model reveals in greater detail the buildings on the Kalinin Prospect. Photo right (taken in August 1967) shows them nearing completion on the newly widened and extended thoroughfare. Bottom right, another project now achieved—the Rossiya Hotel. Located next to Red Square and facing the Moskva River (in foreground) it accomodates 6,000 guests.

Photo © APN - I. Denisenko

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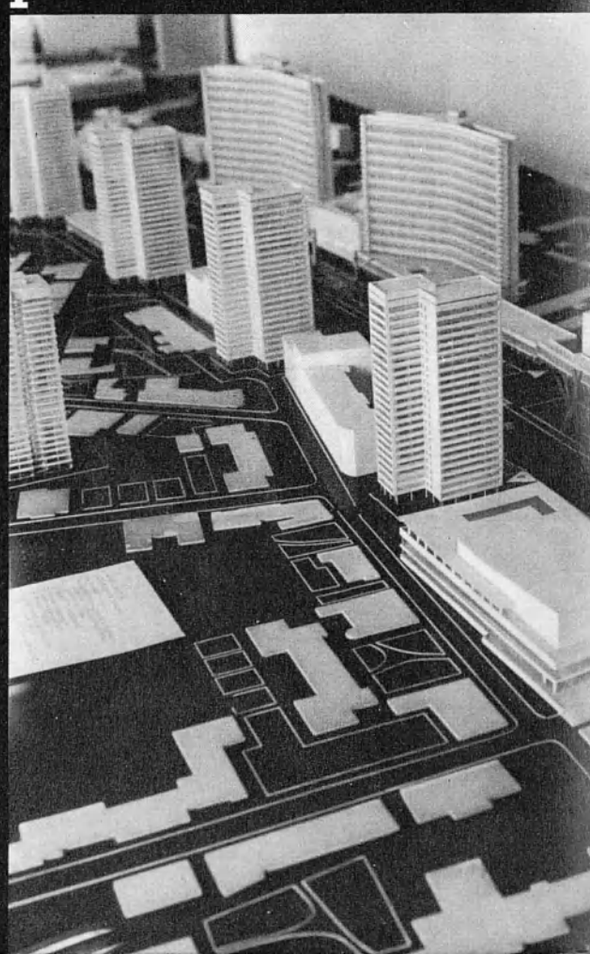

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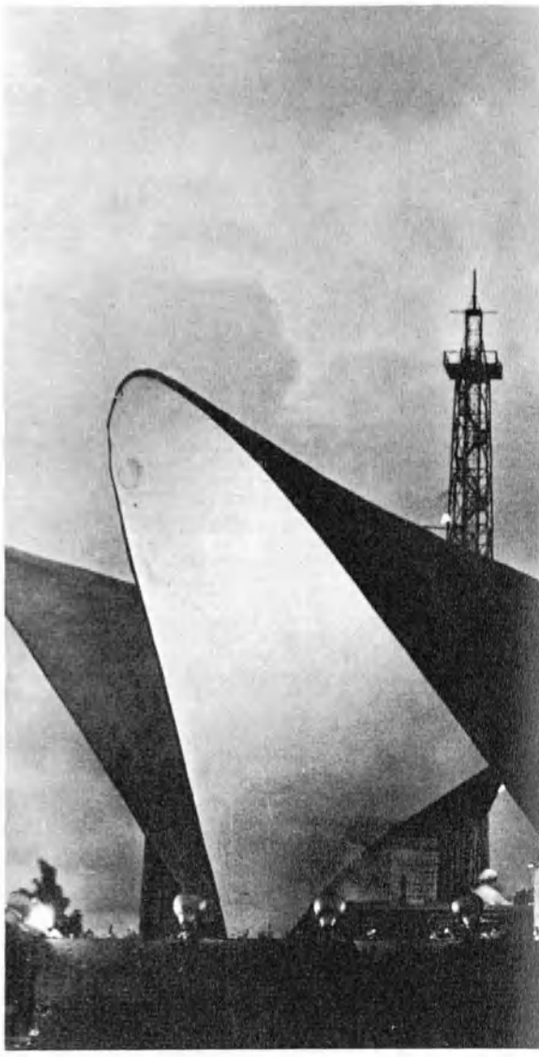

NEW FORMS & MATERIALS

Soviet architecture today is characterized by a use of bold designs in which modern forms and functional needs are kept in mind. Architects use marble, ceramics, wood and other traditional building materials in conjunction with more modern elements such as concrete, glass and aluminium. Top left, entrance hall of the Palace of Congresses in the Kremlin. Its chief architect, Mikhail Posokhin (see page 22) was awarded the Lenin Prize. Top right, winged silhouette of "The Dove", a terrace cafe in Baku, capital of the Azerbaijan Republic. Left, distinctive semi-circular arches in one of Moscow's underground stations. Right, Palace of Sports in Minsk, capital of the Byelorussian Republic, can seat 6,000 spectators. Destroyed during the Second World War, Minsk has been completely rebuilt in a modern style.

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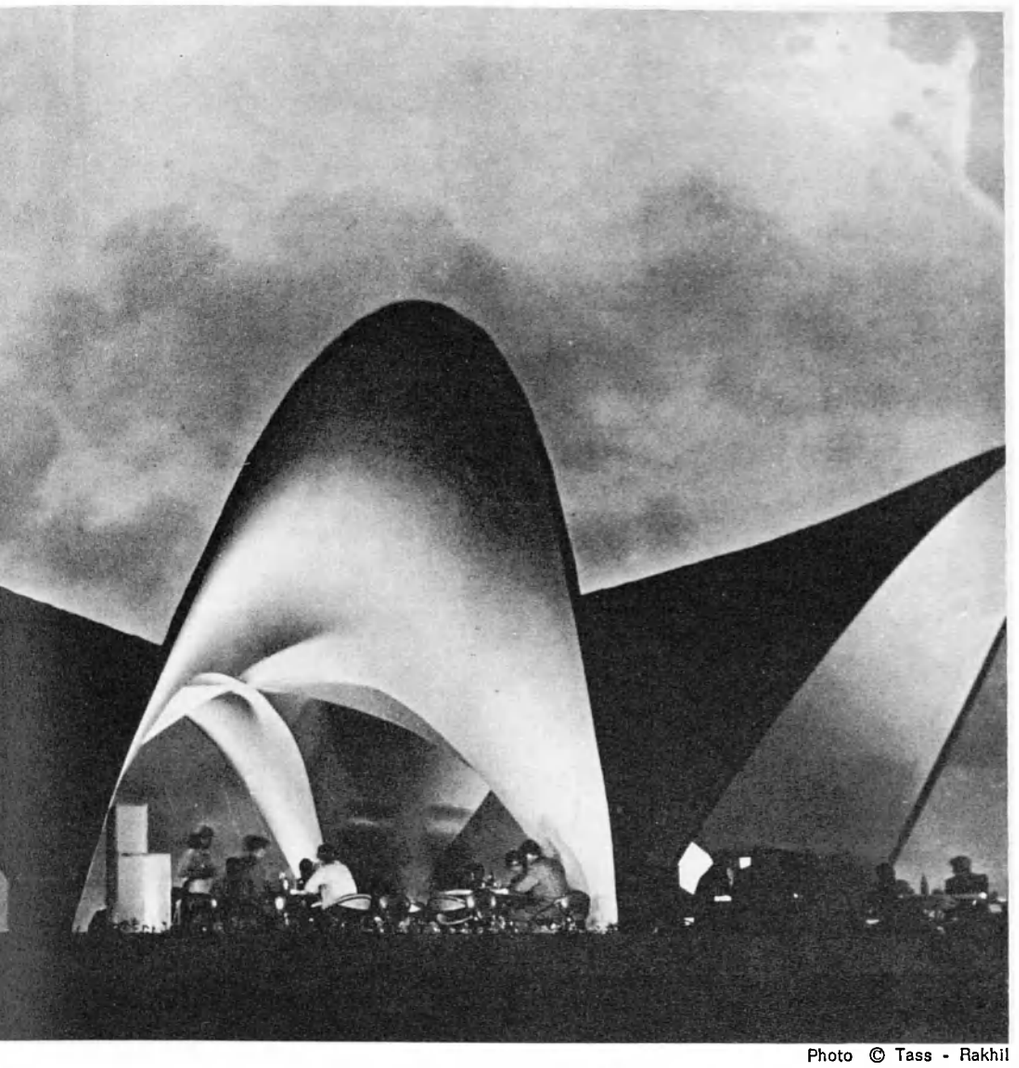

Photo © Tass - Rakhil

Photo © APN

more than 40 years of my life to film-making, that phenomenal art born of the twentieth century, inseparable from scientific and technical achievements and part and parcel of the mainstream of modern life.

Perhaps the best way to get a true picture of our age might be to view one after another, all the great films of the 20th century, from Griffith's "Intolerance" and Eisenstein's, "Battleship Potemkin" to the pictures of 1967.

Naturally, the cinema could not have performed this historic feat if it did not rely on the complex nature of the other arts that produced the synthetic essence of the cinema and gave it life. Consequently, film-makers, giving the truth its due, never forget that literature is the father of all the arts, and music their mother.

When I go back in thought to the sources of Soviet culture, I see, along with men who were close to me professionally, besides 25-year-old Eisenstein, the gigantic figure of Mayakovsky, his contemporary, and 18-year-old Shostakovich.

Their generation started life along with the many millions who had just crossed the threshold into our great era.

Here it would be well to recall what Czarist Russia was like in the opening years of the 20th century, an empire sprawled across two continents, from the Baltic and Black Seas to the Pacific.

When I close my eyes on a sleepless night, the memory that recorded childish impressions for my whole life brings back a picture of the fat policeman who stood on the corner of Malakhovskaya Street in Ekaterinburg, where I was born, and the street itself, knee-deep in mud in spring and autumn. I recall the houses of the merchants as they stood jutting up in the midst of wretched hovels. Those houses resembled chests of drawers, filled with bed-bugs and fetid stupidity, with the arrogance and quivering flesh of somnolent gluttons. I recall the village where I spent the years of my childhood, with its completely natural economy, where each fed and clothed himself and his family from what his pitiful farm could produce.

So it went all over the country, with the exception of a few cities where living conditions came up to the modern standards of amenities in the age of steam and electricity.

Towering over all this were ancient Moscow and St. Petersburg, the resplendent capital of the Russian empire and the home of Russia's wealthiest landowners where, side by side with the glitter of court society, there arose a great national culture that gave mankind such men of genius as Dostoyevsky, Pushkin, Tolstoy, Chekhov, Gogol and Shevchenko.

Somewhere far away, vaguely

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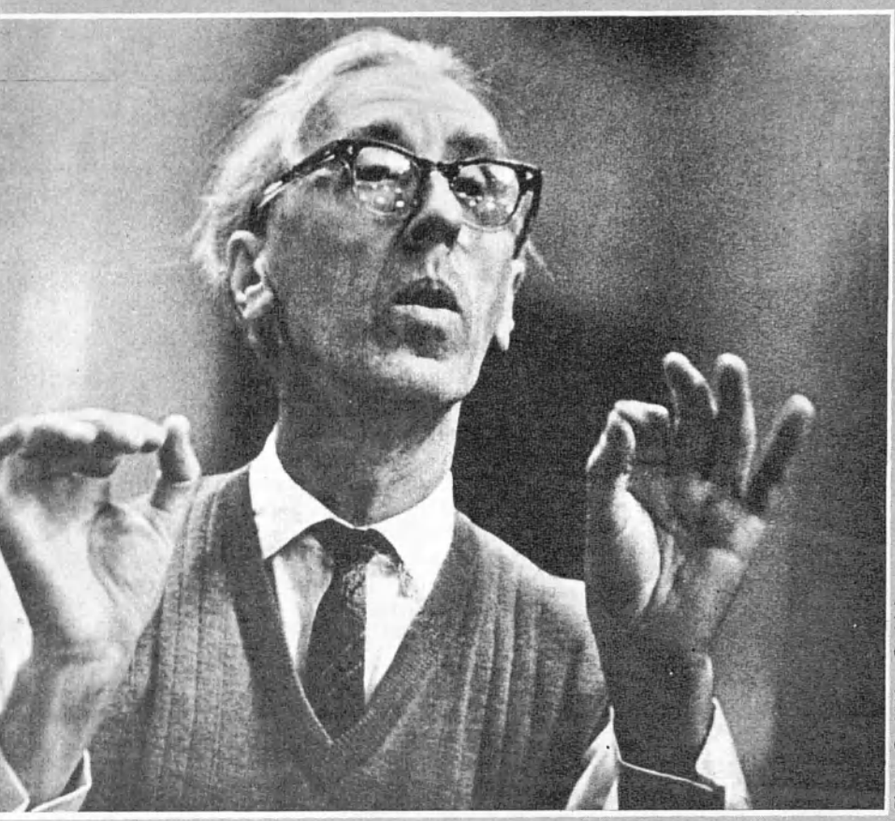

Photo © APN - O. Makarov

Soviet conductor and composer Dimitri Kabalevski at rehearsal (left). Kabalevski, born in St. Petersburg in 1904, has written ballets, symphonies, chamber music and operas including "Colas Breugnon" (1938), inspired by a work of the French writer Romain Rolland.

Photo © Fotofid, Madrid

Yevgeni Evtushenko the poet, born in Zima, Siberia, in 1933, is immensely popular with Soviet youth. His reputation quickly spread beyond his country and his works have since been translated in several languages.

Photo © APN

The works of Dimitri Shostakovich (left). who was born in St. Petersburg in 1906, fall into two periods. After avant garde musical research, he turned to major works such as his "Song of the Forests" and his well-known symphonies, including the 7th (The Leningrad), written in the besieged city in 1941.

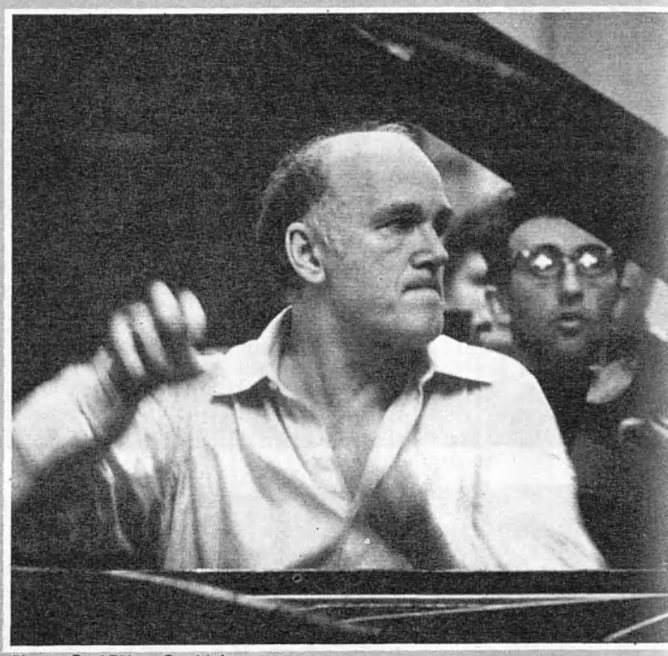

Photo © APN - O. Makarov

SOVIET CULTURE *(Continued)*

Kirgiz novelists and Armenian painters

known to the Czar's officials and quite unknown to the city dwellers, were tens of millions of men and women in tree-bark shoes and homespun clothing. And still farther away were the alien folk, whom even the Czarist governors who ruled them could not make out. To the man in the street these distant people were no more than geographic elements and not human beings of different races with their own soul or mind or heart. They viewed them as objects without feelings, without language or alphabet.

All this is what Russia inherited when Czarism collapsed. The October Revolution decided the history of our country. It set out on a new road.

Here is where the sacramental question arose, the question Romain Rolland later formulated as "On whose side are you, masters of culture?" To the Russian intelligentsia's honour, it had the insight, spiritual force and common sense to make its choice. Our people will never forget that side by side with them were such giants as Pavlov and Timiryazev, Blok and Mayakovsky, Meyerhold and Stanislavsky, Petrov-Vodkin and Nesterov.

In all justice, it should be noted that many of Russia's prominent intellectuals were unable immediately to understand and accept in their hearts the immense changes taking place in their native land. They were frightened by the austere and inexorable early years of the Revolution and left. Later, many of them returned home. Others remained abroad to the end of their days.

The twenties brought many new names into the new Soviet multinational culture. The awakening of new strata of society and of entire nationalities, who for the first time received the right to self-determination, to a written language, to be heard, the peoples who now comprise the Union of Soviet Socialist Republics.

Significantly, many people who come to the Soviet Union, whether from America, Europe, Africa or distant Australia, are eager to visit,

Leningrad, long distinguished as a centre of the performing arts, has nearly a score of theatres and concert halls. Audience (right) is attending a gala performance at the celebrated Kirov Theatre of Opera and Ballet.

Prestige of music and poetry

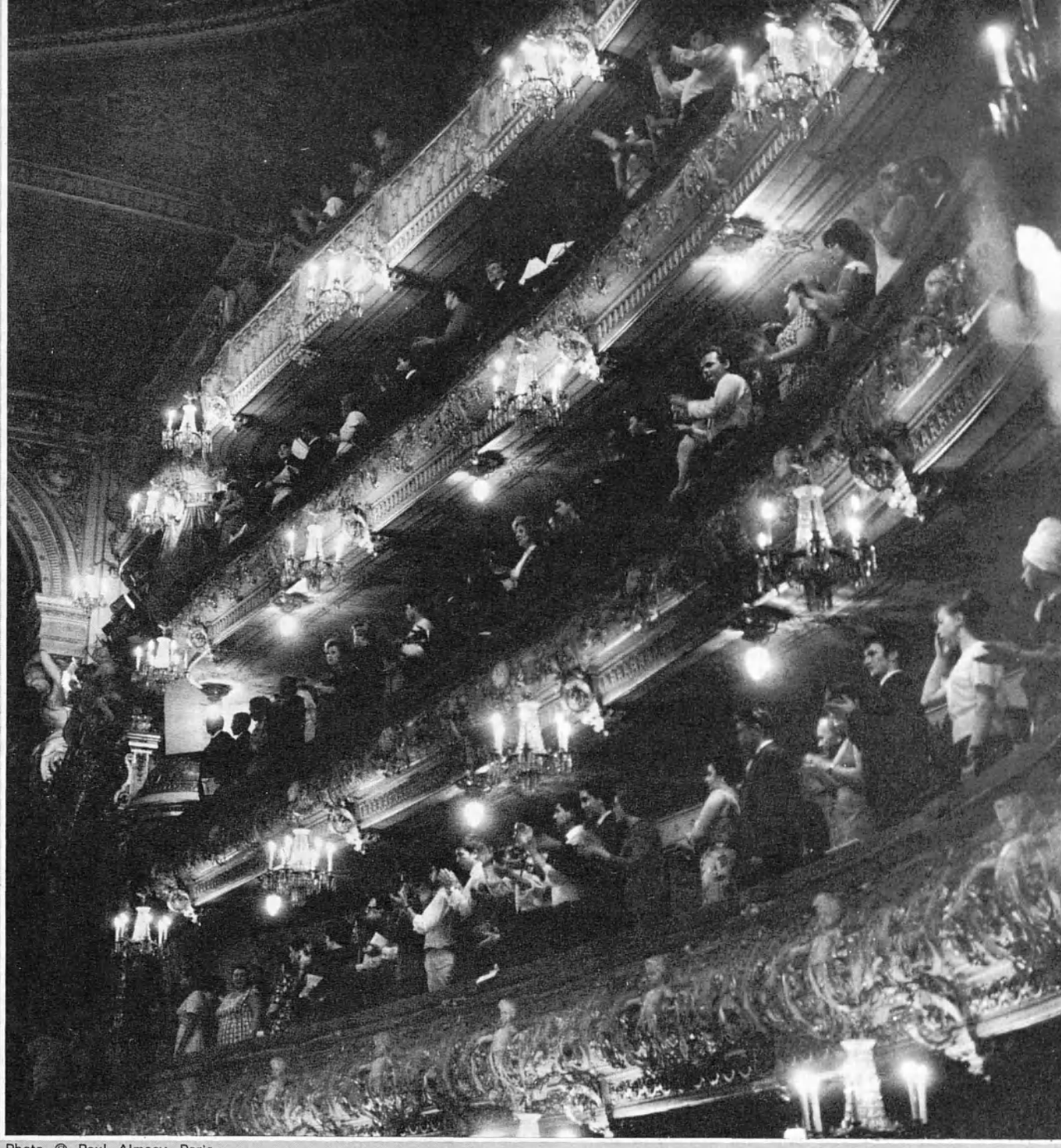

Photo © Paul Almasy, Paris

Left, Soviet pianist Svyatoslav Richter, born in 1914, is one of the world's great interpreters of Bach, Beethoven, Hayden, Scriabine, Debussy and Prokofiev. He was awarded the Lenin Prize in 1961.

besides Moscow, Leningrad and Kiev, the Central Asian republics, once the most remote border regions of the Russian empire. Whether writers, artists or businessmen, they often return from Central Asia deeply impressed by what they saw even in the shortest of visits. It may be that the phenomenal flowering of these Central Asian republics is the most striking testimony to the moral as well as economic victory of our country. We ourselves regard this achievement as our greatest. To us it is all the more revealing because we know what those places were like before.

Any list of the most respected, world-famous Soviet artists, writers and musicians would be extremely long, but the very first names would certainly include the brilliant Kirghiz novelist Chingiz Aitmatov, son of a shepherd; the poet and war hero Musa Jalil; the truly amazing poet and philosopher Rasul Gamzatov; the inexhaustibly gifted Armenian painter Martiros Saryan and his fellow countryman Aram Khachaturyan, and Kara Karaev of Azerbaijan.

Having mentioned a few names, without which what I want to say might seem abstract, I think it would be well to consider how it came about that an illiterate country, condemned to spend its long winter nights by the light of rush candles, was able to make such a colossal leap forward. Naturally, when the country embarked on its active post-revolutionary development it progressed along with the rest of the twentieth century in spite of the inevitable isolation it was forced into.

The tremendous thirst for knowledge awakened by the cultural revolution in the twenties made the Soviet citizen perhaps the most avid reader in the world. With books having remained silent friends and companions of each individual reader, a special Soviet way of living with literature has come into being. The readers' conferences held regularly at hundreds of thousands of libraries and factory and rural recreation centres, and poetry readings before audiences of many thousands are but two of the new features characteristic of our culture.

On several occasions I have accompanied visitors from abroad to such gatherings. I could not help feeling proud of the impression our readers' conferences made on them: The heated arguments, keen observations, ability to understand the literary implications below the surface, and the appreciation of style.

This brings to the forefront an important feature of modern social man, in the best meaning of the word, and that is his unselfish interest in matters of common concern, and his sense of responsibility for the moral achievements, in which each sees a

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Controversies on the borders of realism in art

major fruit of his labours. It is not only houses, factories, shops and handsome streets and cities that reveal the level of a civilization. The most important yardstick is man himself, his code of ethics, his attitude to the world, to good and evil, to strength and weakness, to the goal of life. That is what the reader looks for in the books he reads, the plays he attends, the new paintings and films he sees.

At this point the eternal debate arises: what is art, what is its purpose? The debate arises with greater and greater force at every new dividing line in history. Many are inclined to accuse us of utilitarianism, of being didactic, even of distorting the sacred predestination of art by applying it to the practical needs of society, to the organization of government itself. That is both true and not true.

It would be hypocritical and false to dismiss that view—I would not call it an accusation—out of hand. We have no intention of either cancelling, or evasively skirting, the specific features of our way of life.

Yes, all of us—writers, artists, musicians and film-makers—are co-operating in a gigantic programme on which we have embarked at the call of our hearts and in the interests of our own people and other peoples who continue to be threatened by a great number of dangers derived from brutality and despotism.

The programme is so important to us and is so much a part of the substance and content of our life that most of us are unable to draw a strict dividing line between our personal concerns and the concerns of society. Speaking without any of the propagandistic accentuation which the modern man so abhors, and within the framework of discovering the truth, a man's work, if he is completely engrossed in it, is an integral part of his private life, sometimes much more so than purely family matters.

It is this heightened personal attitude on the part of everyone working in the extensive sphere of culture, a sphere encompassing all the meridians and parallels of our vast country, that makes up the essence of our attitude to the importance and significance of one or another artistic phenomenon.

In our professional environment it is natural that there should be controversies concerning form, the borders of realism, and the breadth of its shores. I see no harm at all in the fact that the debate often reaches a high pitch of intensity.

It is because they are seemingly so innocent and bloodless that literary and artistic battles often grow aggravated with remarkable ease. Here the youth naturally play a special part. Doing their duty in the succession of generations, they logically act according to the dialectical law of "negation of the negation."

We would be poor dialecticians if this circumstance were to fill us with undue fears. We know definitely that in the development of that law any negation must be followed by an affirmation, which will be followed by another negation-affirmation, since in our concept of the world everything is continuously developing.

That is why, while we are aiming at the future, we cannot discard the past with curious arrogance or infantile naivete. To us, the historical process is continuous. This was clearly formulated by Lenin in his argument with Bogdanov concerning the attitude to a cultural legacy.

To us, modern art draws on the greatness of ancient and medieval art, the Renaissance, and the art of the recent past, in which before our eyes there arose the brilliant figures of such artists as Picasso, Diego Rivera and Siqueiros, men who have never for a moment separated their art from the interests of humanity and who have waged violent battles, sometimes with themselves, for artistic truth.

Hence, to us the names of the young poets who now tour many countries and have become widely known in Europe and America, the names of Evtushenko, Rozhdestvensky and Akhmadulina, are all signs of the times, contemporary features of our many-levelled culture, inseparables connected with the interests of all men.

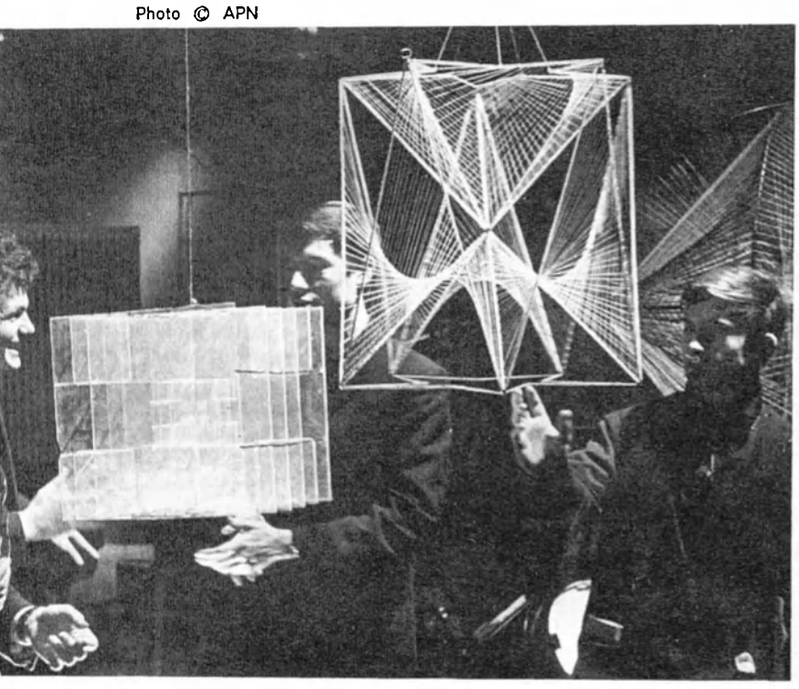
Behind these poets stand the people, who have the right both to love them and to make demands on them in keeping with the laws of spiritual unity that have become the foundation of our community. Again, this is a special feature that may appear awkward, even unbearable, to the solipsist artist, whose only life companion is himself. This is a principled difference we have no intention of either erasing or evading. The difference lies in the very depths of our society and our national traditions, the traditions of the Russian intelligentsia, which from Pushkin and the Decembrist poets, throughout the brilliant writings of the nineteenth century by Gogol, Shevchenko, Hertzen, Tolstoy and Dostoyevsky, showed that it had inseparable spiritual ties with the people.

Now the people, too, have changed. They produce from their depths much new talent that is shaped gradually, in amateur groups, in factory literary clubs, at public lecture courses on the arts. Before you know it, you have world-famous groups like Igor Moiseyev's folk dance company, which has scored a truly unprecedented success all over the world.

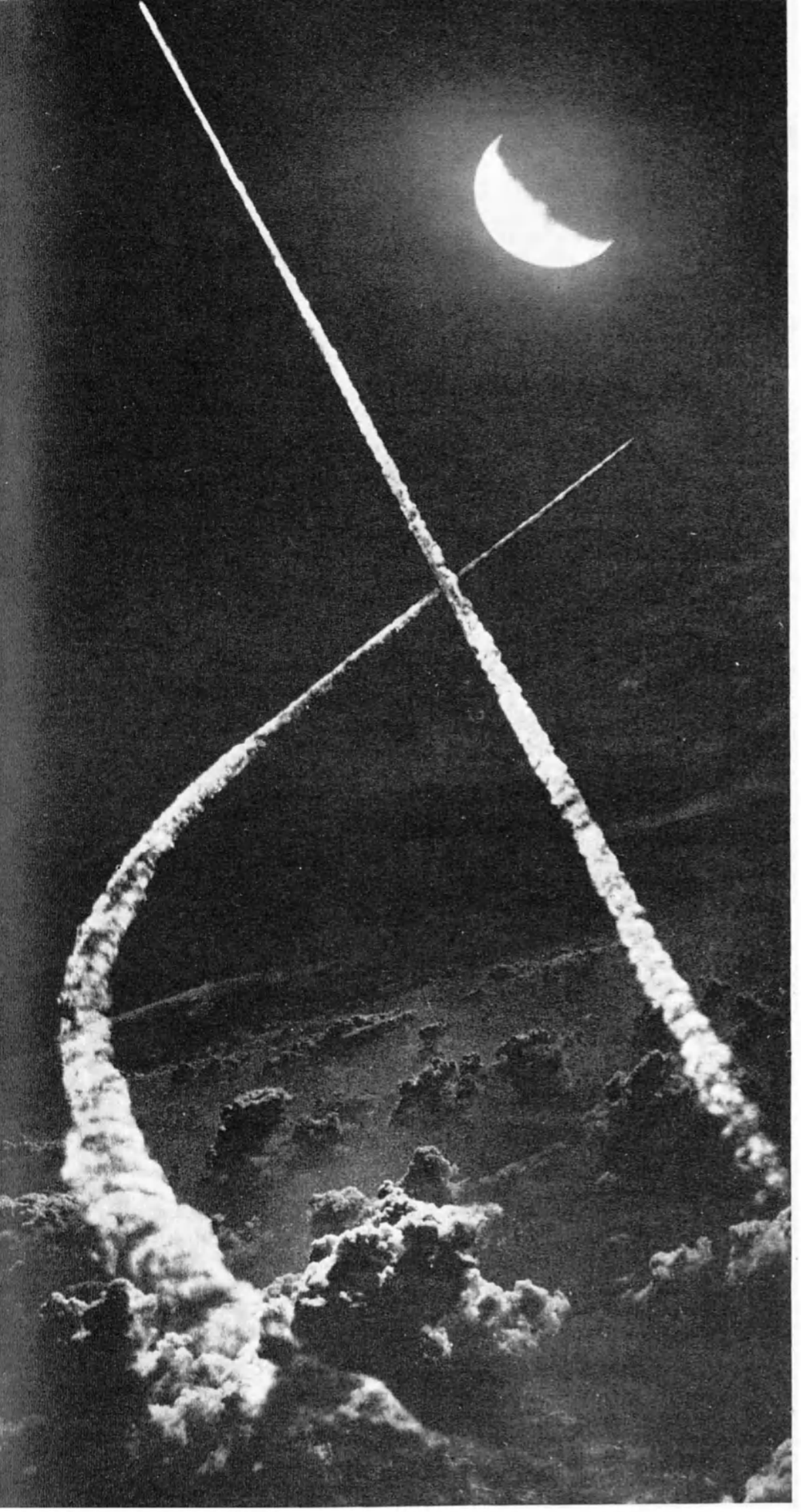
As a film-maker, it would be only fitting if I were to pay some tribute to cinema art in this brief survey. Without beating about the bush I could simply list the dozens of first prizes won at international film festivals. But what is the use of self-praise and self-glorification? History judges us. We are only 50 years old, a mature age for human beings but youthful for a country.

As I look backward, and then into the future, I think: each of us can say he is growing older, and that we are all mortal, but the advantage of our life has been that we have devoted it to mankind's youngest cause.

Photo © APN



Young artists visit an exhibition of Kinetic Art in Moscow. Some of these art forms are based on mathematical formulae projected in three dimensions. Others show moving elements of light. In the past few years there has been growing interest in the U.S.S.R. for modern Kinetic Art, and exhibitions have been held at Dubna and elsewhere.



Ten years ago, on October 4, 1957, the Soviet Union opened the Space Age by launching the world's first artificial satellite. This achievement heralded a decade of space research and exploration that already numbers manned space flights, rendezvous between space vehicles and "walks" in space by astronauts, scientific instrument probes to the Moon and Venus and artificial satellites for long-range weather prediction and colour television via space. This striking photograph (entitled "The Roads to Space") of two research rockets bound for the upper atmosphere was a prize-winning entry in a 1966 Interpress photo contest in Moscow.

Photo © A P N - V. Lebedev

700,000 scientists in the U.S.S.R. in 1967

by Mikhail Lavrentiev

In 1913, scientific workers and lecturers in Russion higher educational establishments numbered about 10,000. Today, the Soviet Union has about 700,000 scientific workers—a quarter of all the scientists in the world. Under the Soviet régime, the membership of the Academy of Sciences has grown to more than two hundred times its former size, and there has been an almost one-hundred-fold increase in the number of scientific publications.

Each Republic of the Union has its own Academy of Sciences, with well organized and equipped scientific centres engaged in various types of research. For example, the Academy of Sciences of the Ukrainian S.S.R. has about fifty scientific institutes.

Soviet physicists have synthesized chemical elements 102 and 104 of the periodic system of Mendeleev. Not far from Moscow, near the ancient

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MIKHAIL LAVRENTIEV *is the founder and present director of Akademgorodok, the new city entirely devoted to science, built in the heart of Siberia near Novosibirsk. A Vice-President of the U.S.S.R. Academy of Sciences and head of its Siberian branch, he is know primarily as a distinguished mathematician, but has also won international recognition for his work in aerodynamics, hydrodynamics, explosion theory, high velocity collisions and seismology.*

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The mushroom growth of research centres

Russian town of Serpukhov, the world's most powerful particle accelerator, a 70-Bev proton synchrocyclotron, will soon be in operation.

It cannot, of course, be said that Soviet science began in a vacuum, for Russia had great scientists before the Soviet Revolution. The history of science has an honoured place for such researchers as Nikolai Lobachevsky, the inventor of non-Euclidean geometry, Dmitry Mendeleev, the creator of the periodic system of chemical elements, Aleksandr Butlerov, the author of the first works on the structure of organic compounds, and Ilya Mechnikov, one of the founders of immunology, the science which investigates the defensive mechanisms of the human organism.

The Czarist Government, however, often attacked daring scientific thought, with the result that the general level of development in pre-Revolutionary Russia was very low.

Despite the extremely difficult conditions created by the Civil War (1918-22) foreign intervention, the blockade and the economic dislocation which affected every region of the country, Lenin and his colleagues never lost sight of the needs of Soviet science, then in its infancy.

It might be thought that, in a country whose industry and transport had been destroyed and whose agriculture could barely provide a starvation level of sustenance for the population, the first duty of the nation's leaders would be to foster the development of applied scientific research yielding immediate practical results, and that abstract science could wait.

But it was clear to Lenin that the new society could not be built without the active participation of the basic sciences, for that was the only way in which conditions favourable to the rapid growth of applied research could be created. Otherwise, the U.S.S.R. would be condemned to perpetual dependence on foreign science.

Lenin knew that unless a sufficiently high level of development were attained in mathematics, physics, mechanics, chemistry, biology and the other natural sciences, plans for building socialism would remain merely Utopian. He therefore used all the means in his power to mobilize scientists and direct their efforts towards the development of fundamental scientific research and the establishment of large, modern scientific centres.

As early as the years 1918-1920, physico-technical, optical and radium institutes were set up in Petrograd (today Leningrad) while Moscow saw the establishment of institutes of physics and biophysics and of the Central Institute of Aerodynamics—the famous "Tsagi" which has produced the greatest Soviet mechanicians, aircraft constructors and rocket engineers. From 1920 onwards, the number of scientific centres increased year by year.

A second, extremely important reason for the dynamic growth of Soviet science was the introduction of a universal system of popular education which made it possible for talented young people to have scientific training.

Much was also due to the fact that, from the very first years of the Revolution, scientific research was organized on the basis of an integrated national plan, under which goals and objectives for the study and solution of the most pressing problems of science and technology at any given time were fixed with reference to scientific developments in the world as a whole. The Soviet Union is perhaps the first country which has organized its scientific planning on a nation-wide basis.

In 1920, Lenin initiated the preparation of the famous "Goerlo" plan, which provided for the building of a vast network of power stations and for the development of industry over a period of ten to fifteen years.

Lenin's electrification plan—like all subsequent scientific and economic plans—proved eminently feasible, for the targets set by "Goerlo" were two to three times over-fulfilled.

After the victory of 1945, world science embarked on a new course mapped out by the whole of its previous evolution. Practical applications were found for the results of a great deal of basic research, notably in atomic energy, electronic computing and the exploration of space.

In nuclear physics, Igor Kurtchatov contrived to build up around him and to organize large groups composed of the finest engineers and researchers in various special fields. Soviet scientists, for instance, were the first to use hydrogen as a nuclear fuel.

In the conquest of space a predominant rôle was played by Sergei Korolyov. He, like Kurtchatov, had a genius for co-ordinating the work of researchers and constructors. Soviet scientists and engineers were the first to put into orbit an artificial satellite and a manned capsule. The launching of the first sputnik was a tremendous spur to the development of world science.

The last ten years have been marked by the accelerated growth of research centres, both in number and in quality. Apart from questions of nuclear energy and the exploration of space, there are many centres actively engaged on

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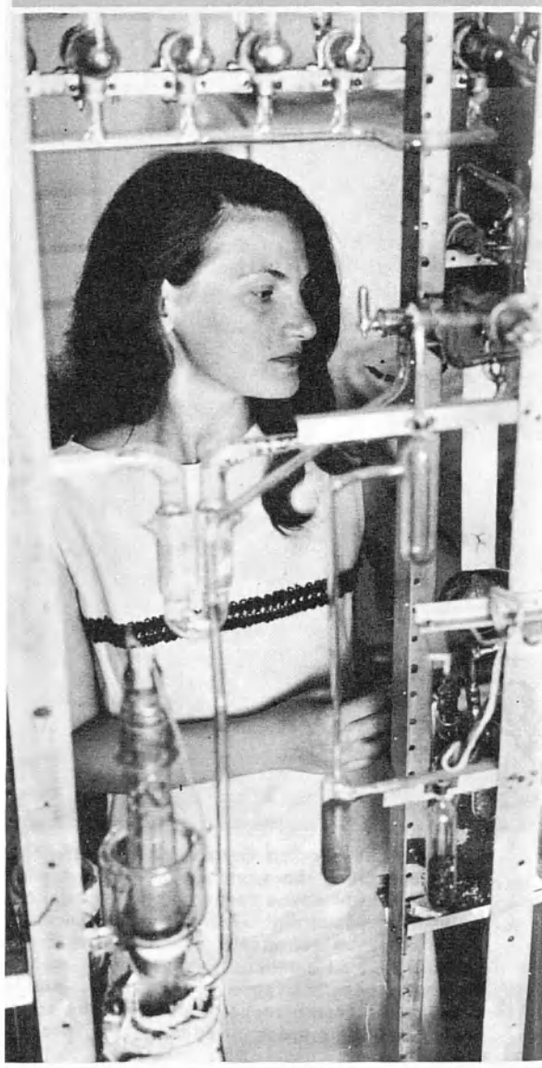
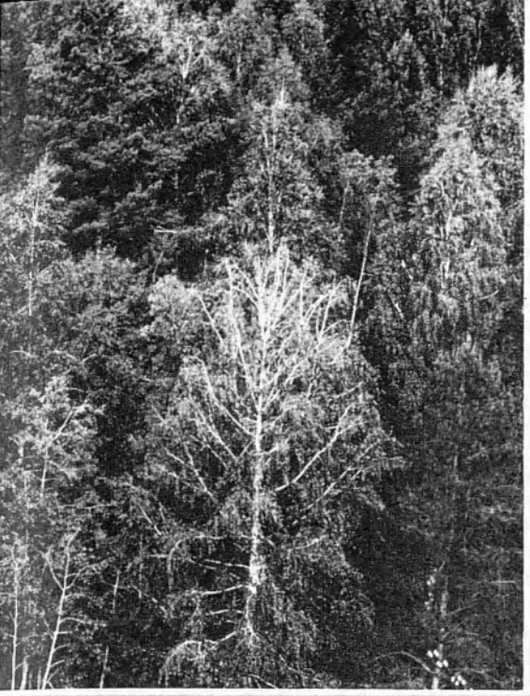
A Science City rises from the Siberian Taiga





Almost completely undeveloped before 1917, Siberia has since undergone startling transformations. Novosibirsk (600 miles north east of Lake Balkhash and close to the Ob River) had 20,000 inhabitants in 1910. Today it has one million. Already a big industrial centre, the city has also become the scientific capital of Siberia with the creation of Akademgorodok, known as "Science City." Twenty-five miles from Novosibirsk, over 3,000 acres of virgin forest were cleared as the site of a campus on which have been built 20 research institutes (above right), a university, and a special mathematics college for outstandingly gifted children selected by scientific "Olympiads". Above centre, entrance hall of the hotel built to accomodate newly-arrived scientists and students. Above left, hidden in the trees are the homes of the several thousand scientists who work at Akademgorodok. Below left, laboratory at Science City whose Nuclear Physics Institute is completing a giant proton-antiproton installation with an energy of 1200 BeV (thousand million electron volts). Below right, a shopping centre, one of Akademgorodok's many community facilities.

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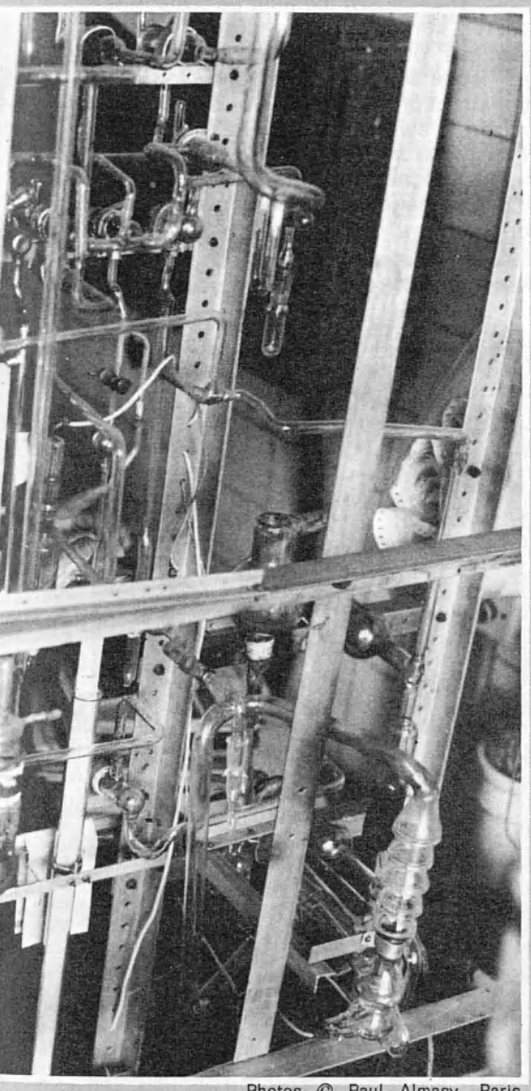
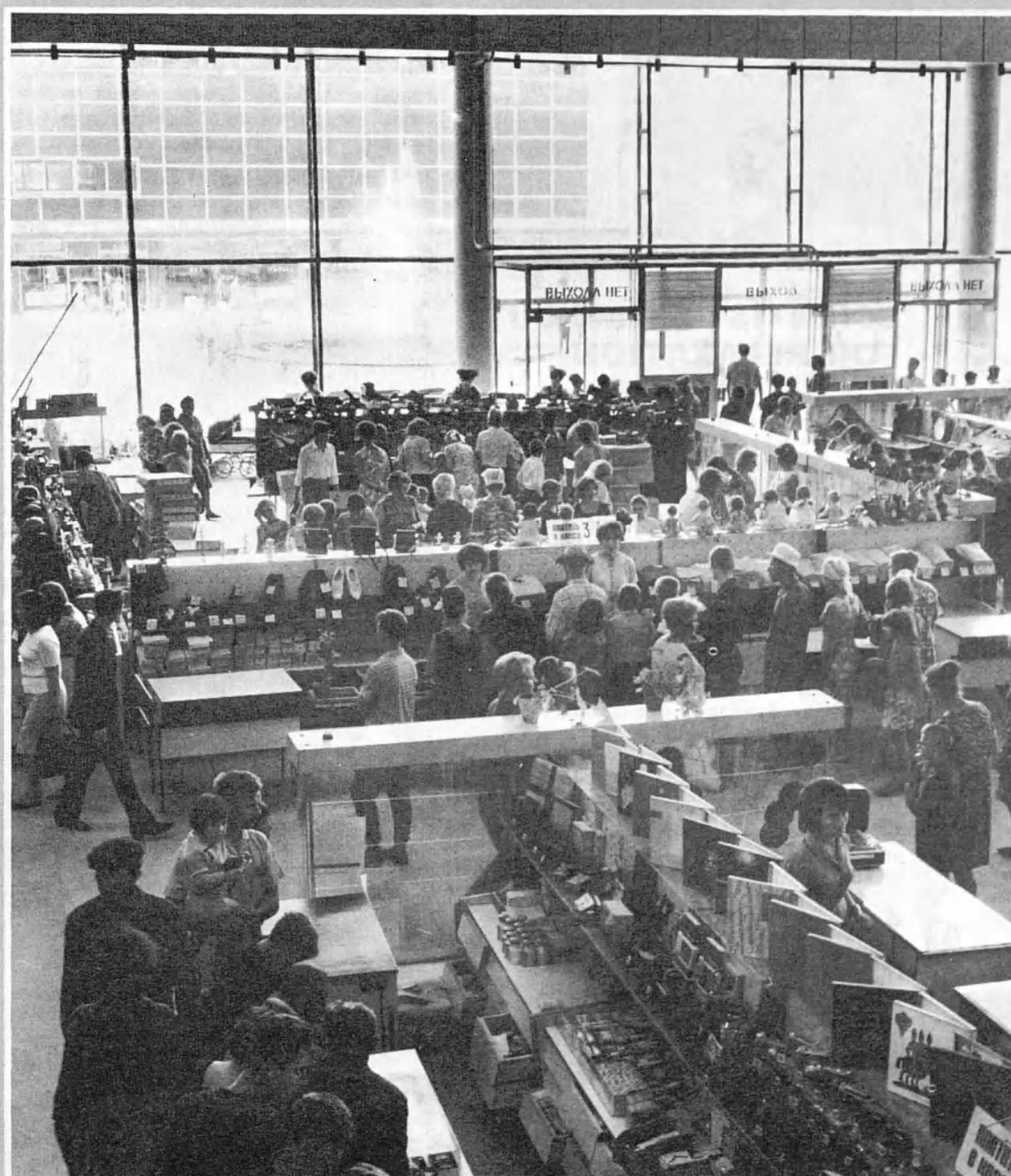


Photos © Paul Almasy, Paris



Siberia, open door to science

basic research in mathematics, engineering, solid state physics and high energy physics.

In the last twenty years, mankind has been experiencing a tremendous scientific and technological revolution, which has confronted science with a number of complicated scientific and organizational problems that are preoccupying not only scientists but governments in many countries.

Answers must be found to questions such as that of determining the most effective structure and location for a country's scientific institutes; planning scientific development at a time when the volume of scientific knowledge can double in ten or twelve years; finding the best ways of selecting and training scientists and skilled workers, the demand for whom is growing by leaps and bounds; and somehow strengthening the link between science and the national economy.

As an example of how we in the U.S.S.R. are tackling problems of this type, I should like to say something about the work of my own department —the Siberian Section of the Academy of Sciences of the U.S.S.R.

From the earliest years following the October Revolution, Siberia and the Soviet Far East experienced a massive development, both economic and cultural. Universities sprang up at Irkutsk and Vladivostok; schools and factories mushroomed everywhere and finally a number of branches of the Soviet Academy of Sciences were established. In brief, this wild region, which had previously served chiefly as a place of exile, began slowly to change into a civilized area.

During the first Five-Year Plan there grew up the new metallurgical centre of the Kuznetsk Basin, which today has an essential rôle in the national economy. Siberia's contribution during the Second World War is inestimable; together with the Urals, it sent to the front equipment and fighting men of the highest quality.

Victory won, the Soviet people concentrated the greater part of its energies on reconstructing its shattered towns and factories and restoring a devastated countryside. During this difficult period, only slow progress was made with the development of Siberia. We had to wait until 1956, and the 20th Party Congress, before a fresh stimulus was given to these regions with their fabulous unexplored natural wealth. A plan was drawn up providing for intensive underground prospection, the establishment of an infrastructure for industry and energy resources and a huge network of secondary schools and higher educational establishments. Science was given a fresh start.

To achieve rapid and complete results it was, of course, necessary to reinforce existing establishments—mainly regional branches of the U.S.S.R. Academy of Sciences and government research centres. Above all it was essential to create centres and institutes capable of carrying out basic studies ranking with scientific research at world level.

In 1957 the Soviet Government therefore decided to set up a Siberian section of the Soviet Academy of Sciences and to build a big scientific centre which would be responsible for all the branches and institutes of the Academy of Sciences situated east of the Urals.

A government committee was specially nominated to draw up the statutes of the Siberian section and to establish a timetable for the construction, equipment and launching of the new centres. The committee was given a programme and, drawing upon national and international experience, it began by laying down guiding principles.

The site selected for the new scientific centre was in a pine forest on the

Photo © Paul Almasy, Paris

1

SCIENTIST'S TIME OUT FOR RELAXATION

After working hours, scientists, researchers and students at Science City, near Novosibirsk—young, and not so young—have ample opportunities to enjoy their favourite pastimes.

1. Prof. Guri Martchuk, director of the Electronic Computing Department at Science City, typifies the youthfulness of many top-level scientists at the U.S.S.R.'s second largest scientific centre after Moscow. Average age 33.

2. Young scientists enjoy all types of modern dancing at one of the community clubs. Its name has mathematical connotations —"The Integral".

3. Roller-skating provides an excellent summer exercise for keeping muscles in trim for skiing—a favourite winter sport in Science City.

4. At the doorstep of Science City is a vast artificial reservoir, 125 miles long—known as "Obi Sea". Many people have taken to boating and sailing, and between them now have 400 to 500 motor-boats and yachts.

2

Photo © APN - V. Tchernov

edge of the Obi Reservoir, 25 kilometres (15 miles) south of Novosibirsk. In seeking to attract to Siberia first-rate scientists, it was important to take full advantage of this natural scenic beauty.

Since its foundation nine years ago, Akademgorodok, or "Science City" as it has been called, has greatly expanded. Its citizens today include 16 Academicians, 30 Corresponding Members of the Academy, 95 Doctors of Science and 950 Candidates. Workers and office staff number 16,000.

The centre is concerned with all the major problems of modern science; every branch is represented: mathematics, physics, chemistry, biology, geology and the social sciences, and each yields results of the greatest significance. Some of the work has been awarded the Lenin Prize—nuclear physics research concerning the induced collision of beams of particles, studies on the theory of detonation and on applied cybernetics. Geologists, biologists and mathematicians have achieved remarkable successes.

Scarcely had the organization of the Siberian section got under way than our research teams established close contacts with the industry and economy of Siberia and the Far East. The specific problems of this vast region with its low population density have been studied with particular attention. Our scientists have given hundreds of lectures on current problems of science in towns and in large factories; we have undertaken a detailed study on ways in which Siberia's special climatic conditions hamper the development of industry—notably the mining industry.

Though in most instances we have had to be satisfied with giving general advice, joint studies have also frequently led to close collaboration over several years. Today the institutes controlled by our centre are in permanent contact with more than 300 factories and enterprises in the East.

Joint efforts by scientists and industrialists have enabled us to find practical economic uses for fundamentally new scientific concepts. At Novosibirsk researchers and industrialists are together studying the industrial application of a new technology which uses the method of flash welding to obtain laminated materials. This most promising technique offers almost unlimited combinations of metals to meet desired specifications. For example, we have some "bi-metals" whose resistance to heat and whose refractory and anti-corrosive properties are quite remarkable. These may be of great utility for chemical apparatus, electrotechnical installations, etc.

THE study of the behaviour of dynamically supercharged water has given rise to the "impulse currents" theory and this in turn has enabled us to build a whole range of superpowerful presses intended for stamping out shaped components in different metals. These hydraulic-impulse presses giving an impact energy of the order of 200 strokes per minute are at present undergoing trials in the factories of Novosibirsk. This alliance between science and production is bound to expand in the future.

Unfortunately, experience has shown that a direct transition from science to industry is not always successful; we have seen considerable efforts by both parties end in failure, each side being fully convinced that the other was to blame. The conclusion we draw is that it is no good approaching big industry without adequate preparation, and without realizing quite clearly that the more revolutionary an idea, the greater the need to work it out fully on the spot and to perfect its technology.

In response to our proposal, the Soviet Government has decided to set up a series of pilot plants and construction centres near to Science City. These are intended to be the halfway house between a scientific discovery and its practical application. It is here that students or trainees in the last year of higher studies can, by way of vocational training, gain practical experience in new products and new technologies so that when we submit drawings, technological plans or prototypes to industrialists, we can send them at the same time young people who have played an active part in their creation.

We already have two pilot projects of this nature: one specializing in hydraulic stamping equipment and another dealing with economic evaluation and planning. The first has perfected a new range of machines founded upon the principles already described, and giving pressures and speeds never before attained. The prototypes have been built and are now being tested for resistance to wear and for stability. The second project has a purely economic function; it is already dealing with innumerable inquiries concerning optimum layout of equipment and buildings and the construction of new industrial plants. We are now setting up another pilot plant for research and construction, specializing in small-scale accelerators for industrial use, catalysers, precision instruments, etc.

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Photos © Paul Almasy, Paris

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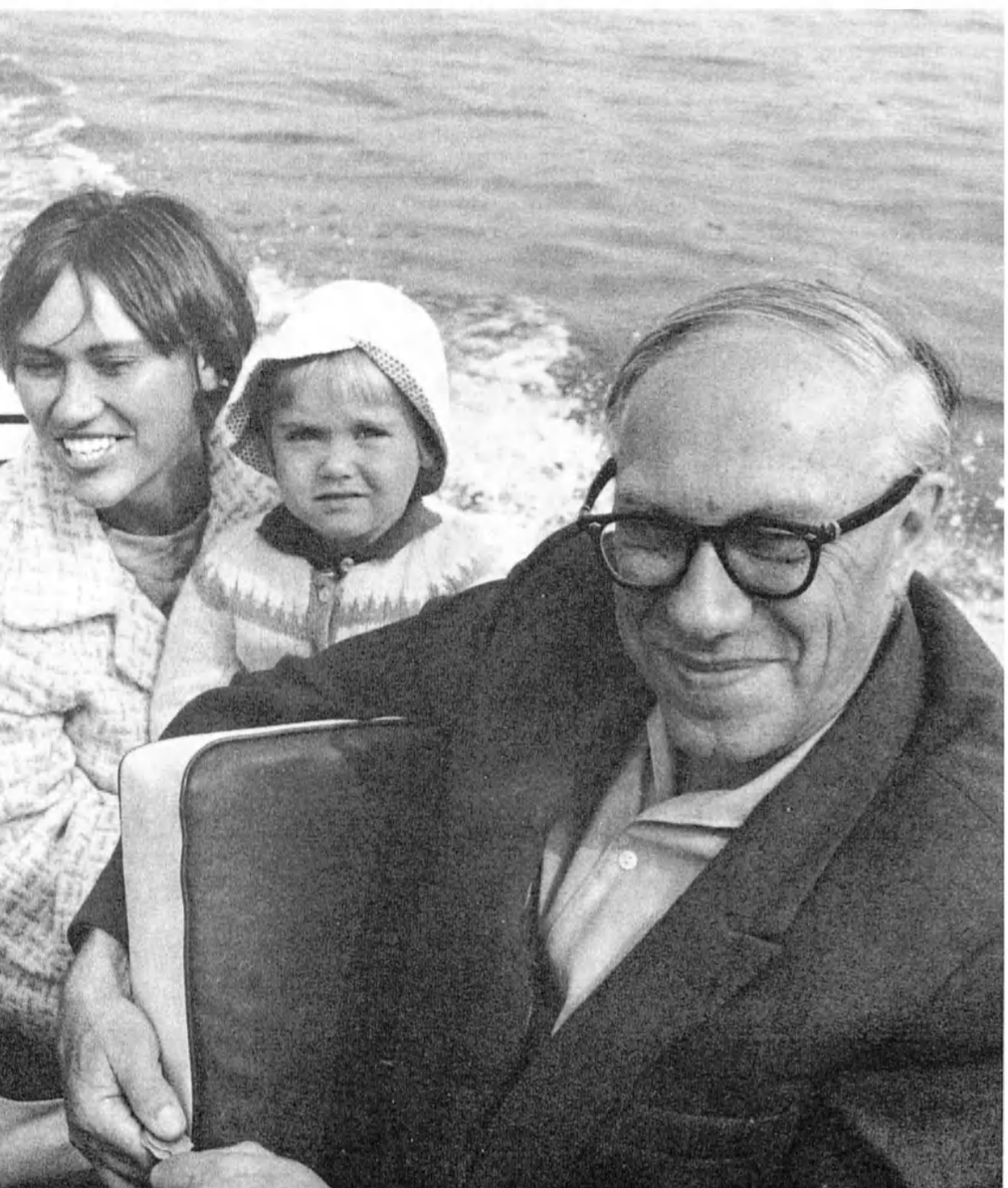
Photos © Paul Almasy, Paris

Founder of Akademgorodok, Siberia's Science City, the distinguished scientist, Mikhail Lavrentiev finds time, between his research, lectures and administrative work, to take an interest in every aspect of its life. Left, Prof. Lavrentiev outside his 8-year-old bungalow—the city's oldest house. Above, at the wheel of his car he stops for a chat with one of his assistants. Below, on a boat trip with his daughter Vera, also a mathematician, and his granddaughter.

The man behind Science City



Since its creation, the Siberian section has consistently sought to attract young talent and to educate and train it. The Soviet Union may justly pride itself on possessing the largest network of secondary schools and higher educational establishments in the world.

The attraction exerted by science and technology upon Soviet youth is unmistakable. In addition to schools, technical clubs abound where youngsters of 10 to 12 years of age build model boats or aircraft, assemble wireless sets and so on. Even so, we consider that the development of our education lags behind our needs—behind the evolution of science and technology.

The shortage of qualified staff is particularly acute in centres of higher education and in those technical fields which are working on the newest scientific discoveries. When organizing our university in Science City, we planned to base our teaching on the system of laboratories attached to the research institutes and to recruit our teachers as widely as possible from among both the older and the younger generations of scientists. That is what we do in practice.

In view of the outstanding educational opportunities which we are able to offer young people and because of the limited capacity of our laboratories, we have naturally had to adopt a system of selection which ensures the admission to our university of talented young people who know exactly what they want to do.

As regards mathematics and physics, and later chemistry, we solved the problem by arranging a selective system of "Scientific Olympics," organized in three stages and open to the largest possible number of candidates. This revealed that in the remote regions of Siberia mathematical aptitudes are underdeveloped solely because of insufficiently qualified teaching staff. Today, therefore, our selection is carried out in depth and we have even set up a residential college for studies in physics and mathematics, specifically for young people who have a natural talent but an insufficient stock of knowledge.

Six years' experience have convinced us of the success of this system. In a few years, not only shall we be able to provide our own replacements, but also to supply other higher schools and research centres with large numbers of graduate and of Doctors in Science, eminently qualified and possessing a high creative potential.

As Science City itself has grown, many branch centres and institutes in the East have also been considerably expanded. The major impetus has been given to the branch at Irkutsk, where the local Institute of Energy has

Photo © A P N

Antennae of a giant radiotelescope installed near Kharkov, in the Ukrainian SSR. It is used to pick up natural radio signals coming from outer space.

achieved outstanding results and now boasts a first-class electronic computing centre. Equally satisfying progress has been recorded by the scientific establishments at Yakutsk, Magadan and Vladivostok.

Having gradually overcome the difficulties of growth, the Siberian section is developing and spreading; its network of research centres is expanding and its contacts with the national economy grow stronger. From year to year the wealth of our country increases, as does the rôle of science in its industry and its economy. Yet while working at our daily tasks, we are also duty bound to look to the future, paying special attention to training a new generation of the highest quality. The future development of our country depends entirely upon the men and women we train today.

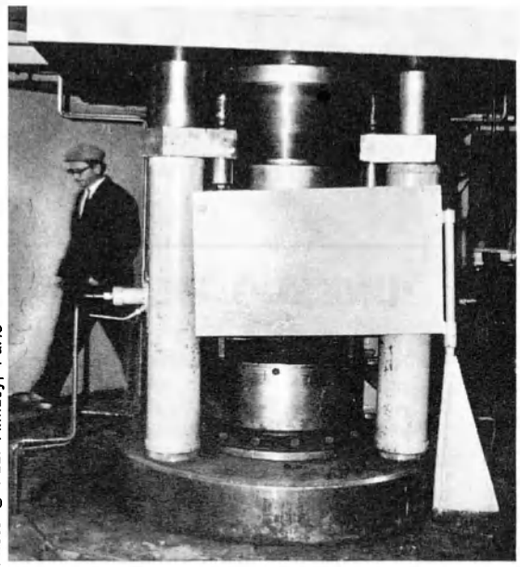


Photo © Paul Almasy, Paris

Left, a prototype hydraulic press. Despite its relatively small size, it is four times more powerful that any similar system hitherto employed in industry. It was designed by Prof. Mikhail Lavrentiev.

A TV programme girdling the world

by Pierre de Latil

OVER six hundred million viewers—one sixth of the world's population—this was the potential audience for the remarkable television programme, "Our World", broadcast on June 25 in 31 countries. Of course, not all these six hundred million people will actually have switched on their sets at that moment; but still one is safe in saying that no show on earth has had such an audience before.

The newspapers have already carried detailed descriptions of the programme itself. But what went on behind the scenes is less well known and just as fascinating.

The idea was born in Spring 1966. For some years now, television stations in western Europe have got together to organize joint transmissions of major sporting events and other spectacles of international interest; these link-ups, no longer a rarity, are arranged by Eurovision, part of the European Broadcasting Union.

At one of the European Broadcasting Union's meetings, the British Broadcasting Corporation put forward a suggestion: why not try for one day to go beyond purely European collaboration and arrange a world-wide hook-up using communication satellites?

The European television organizations were enthusiastic about the project. But in the United States the commercial structure of television caused some difficulties: the broadcast was to last two full hours, and the U.S. network could hardly accept a period as long as that free from publicity. However, the National Educational Television network (NET), a nonprofit organization, agreed to take part. But naturally the audience in the U.S.A. was not as big as it would have been if the programme had been carried by one of the major networks.

What about the other continents? Unfortunately there could be no question of the programme being seen in all countries of the world, and this above all for technical reasons. The broadcast was relayed from continent to continent via satellites in stationary orbit 36,000 kilometres (22,500 miles) above the earth. At present, few countries possess the sensitive aerials needed to receive signals from these satellites.

Of course, the signals, once received, can be sent on to other countries by conventional means—coaxial cables or microwave transmissions—and in highly industrialized regions there are dense communication networks of this kind. But many parts of the world—Asia (outside Japan), tropical Africa even Latin America—lack such facilities.

When the day comes that satellite relay transmitters are powerful enough to be picked up by less sophisticated aerials, direct communication with the whole world will be possible.

The project faced one other major difficulty. Co-ordinating the transmission of "canned" (pre-recorded) programmes is a relatively simple matter. But "Our World" was broadcast "live": what was seen on the screen was actually happening in another part of the world at that very moment. This made the whole operation very much more complicated. But as it turned out, timing was perfect all along the line, and world-wide television passed with flying colours one of the stiffest tests it is likely to meet: perfect co-ordination of a long programme made up of many short contributions which all have to fit together like the pieces of a jigsaw puzzle.

There were tricky problems of "control" to be solved. Let's see how they were tackled. In each country where more than one sequence was to originate, the places where the various contributions were coming from were connected to a "national control". These national controls were themselves linked to "international controls": New York for America, Australia and Japan for Asia, and Brussels for Europe. The signals were passed across the Atlantic and Pacific via satellite, but within Europe they travelled by more conventional means. The "master control" was in London, linked both to Brussels and, by satellite, to New York.

A precise second-by-second timetable had been drawn up, so that each producer, whether he was bringing to the world screen shrimp-fishing in Japan, scenes from Romeo and Juliet in an Umbrian church, or folk-dances in a village square in Mexico, knew exactly when his "contribution" to the programme was due to start.

The nerve centre in London was directed by Aubrey Singer, head of the BBC Outside Broadcast Features and Science Department. As European Broadcasting Union Project Editor, he had in front of him monitors showing the transmission sequence, and test pictures from the next two sequences to follow. He was also in telephone contact with these three units, and was thus able to give them personally their "countdown" and go ahead signal.

As soon as one sequence went on the air, one of the two "waiting" screens became free for the next sequence in line, coming either from Brussels or New York. In the European control room in Brussels, where the French director Alexandre Tarta was in charge, the set-up was the same: two sequences "standing-by" on two monitor screens, and as soon as one of them went on the air, another was switched in from Austria, France or Sweden...

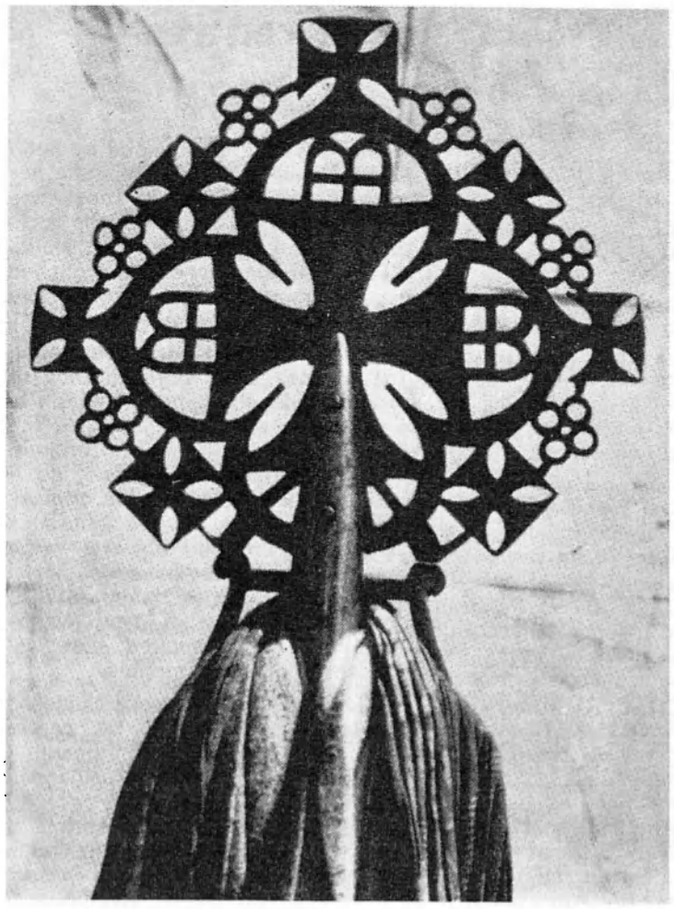
So carefully had the two-hour programme been planned that everything went off smoothly.

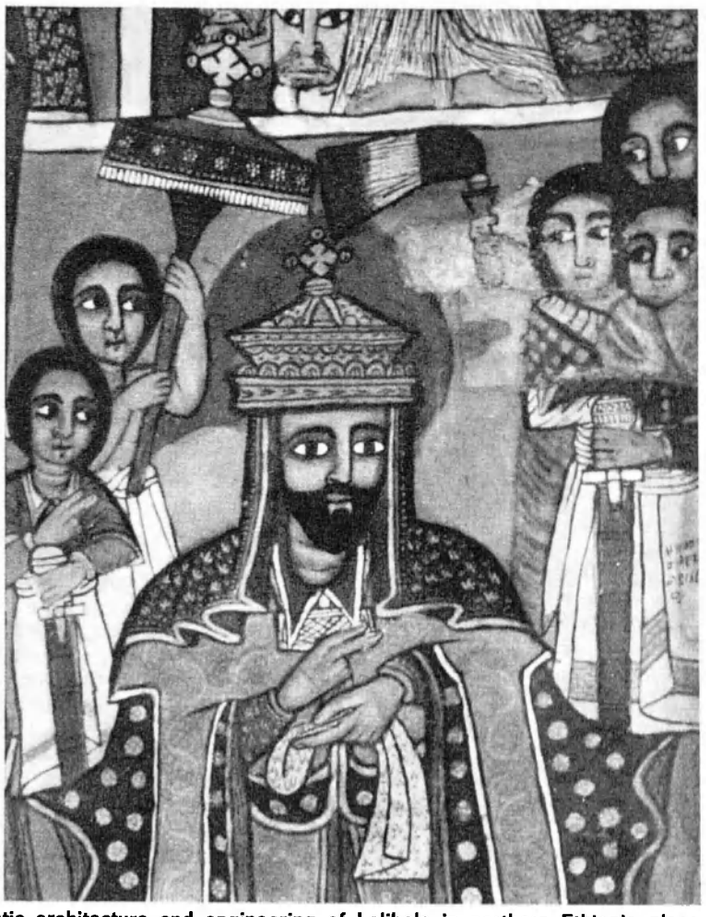
The timing was perfect too, except for one sequence, showing the famous painter Miro at work in the South of France, which overran a few seconds: the artist took a little bit longer than expected to finish a drawing. But after all, age and art could hardly be hurried in the name of technical perfection!

This article originally appeared in "Unesco Features", Unesco's fortnightly bulletin for press, radio and television.

'UNESCO FEATURES'

We wish to draw the attention of press and radio editors to Unesco's fortnightly bulletin, "Unesco Features", whose feature-length articles, columns and news items on education, science and culture reach a world wide public through daily and weekly newspapers, magazines, broadcasting services, youth journals, educational periodicals, the co-operative and trade union press and other specialized publications. "Unesco Features" is supplied free to press, film and radio services but is not available to individuals. First published in 1949, the bulletin now appears in English, French, Spanish, Russian and Arabic. Distributed in some 150 countries and territories, its articles and items are also translated into many other languages.





Photos © Angelini 1967. Taken from "Lalibela, Phase 1" - International Fund for Monuments Inc.

The extraordinary Coptic architecture and engineering of Lalibela in northern Ethiopia place its buildings among the world's great cultural monuments and religious shrines. Eleven in number, they were each sculptured in one piece down into a mountain about 800 years ago. Left, a typical motif of Lalibela. Right, a portrait of Emperor Lalibela of the Zague dynasty, 12th century rulers of Ethiopia, from one of the monuments in Lalibela.

JOURNEY TO ETHIOPIA'S PAST

by Richard H. Howland

Earlier this year Unesco sent a special mission to Ethiopia to help to organize the Ethiopian Antiquities Administration. The mission was headed by Professor Richard H. Howland, archaeologist and architectural historian, who in this article records his impressions of Ethiopia's immense heritage of ancient monuments and artistic treasures. Professor Howland is secretary-treasurer of the U.S. National Committee of the International Council of Monuments and Sites and chairman of the Department of Civil History at the Smithsonian Institution in Washington, D.C.

THE plane from Rome came down at Asmara at 6:30 a.m., with dawn flushing the sky and a rosy hue everywhere, and the full moon in the low western sky pale and fading. A neat attractive new airport building was alert and alive. Inside an attendant behind the bar gave everybody small cups of delicious Ethiopian coffee. Then the sun rose over the distant

CONTINUED ON NEXT PAGE

A major compaign for restoring the three great centres of Ethiopian culture: Axum, Lalibela, Gondar

hill, and the waiting room was flooded with horizontal sunshine as the attendant pulled the blinds at the big windows facing due east. Soon back in the plane for the 50-minute flight to Addis Ababa.

The landscape below the plane was incredible, like blown-up views of the craters of the moon. Dry, desolate, crinkly, for scores of miles as far as the eye could see. No trace of habitation, cultivation, road, or river: untidy sharp dusty hills, a dull red in colour. Later the landscape became more mountainous, with the characteristic high plateaus and steep jagged declivities—the area of the great Rift Valley. Still no habitations, but gradually as we approached Addis and the plane descended lower, little communities could be seen, some winding paths, an occasional stream, and green planting.

ONLY later, during a series of comfortable air excursions to distant towns, does one discover the incredible richness of the antiquities of Ethiopia. This is a land of contrasts; it is so highly developed as a leader in contemporary African affairs, and yet so remote and medieval and untouched in its hinterlands.

The antiquities are glorious and of international significance to archaeologists and art historians, but one travels to seek them outside the capital. In Addis there are only two good museums, and an excellent display of indigenous building types on the grounds of the Ethio-Swedish Building College.

One travels far into the countryside to see the astounding physical remains of the three great peaks of Ethiopian culture: To the north, where Axum and the surrounding lands are filled with obelisks, temples, and tombs of the early centuries of the Christian era, to Lalibela for the unbelievable unique rock-cut churches of the Middle Ages, and to Gondar, the former capital of the Empire, where splendid palaces and churches of the seventeenth and eighteenth centuries show a sophisticated cultural dévelopment that reflects Arab as well as European connexions.

The French archaeologists say it is difficult to date the great obelisks and tombs at Axum more closely than from the second to the sixth century. The obelisks are called stelae. They are monolithic shafts, and there are a hundred or so, most fallen. A few are still erect or have been erected. The largest of the fallen ones (fully carved to represent a nine-story building with doors and windows) is as tall as a nine-story building. It is bigger than any Egyptian obelisk, and is probably the largest single worked stone ever set up by man! The group set in a park is overwhelming.

Nearby is the infinitely moving old cathedral of St. Mary, called the Basilica. It is full of life and hoary antiquity, although the present structure is a replacement of the 17th century. It is on the site of the most ancient and venerated of all Ethiopian churches, and its Axumite terrace foundation of the second to sixth centuries is clearly visible.

The stelae at Axum were probably erected as memorials, as dwelling-places for the spirits of departed personages of importance. Many have window and door motifs cut in low relief, comparable to the fenestration and portal designs of palaces of the period. The palaces were vast in extent, several stories high, and were perhaps comparable to similar structures in the Arab peninsula across the Red Sea, past as well as present. The foundations of many palatial and religious structures of the Axumite period show a sophisticated use of stone construction without mortar, angles re-inforced with larger stones, and rhythmic uses of receding and projecting planes in the wall surfaces.

To reach Lalibela one flies over the massive stone "needles" rising in the mountainous landscape, on which political prisoners were isolated. It is easy to see that they could never get down. The unbelievable aspect is how anybody ever got up to the tops of these shafts that seem to rise 300 or 400 feet vertically up, with no visible slope for ascent. Yet from the plane one sees on the top of one of them various walls and the ruins of a vaulted house. From the airstrip terminal the town of Lalibela is 40 minutes away by Land Rover, crossing one of the most magnificent changing landscapes of mountains and valleys in the world.

THE town is large, and noted for its two-story circular dwellings with thatched roofs. At the far side is a comfortable hotel, The Seven Olives, built a few years ago under the direction of Princess Ruth Desta, who also has supervised the restoration programme of the great rock-cut churches here, which has elicited the interest of Unesco.

There are nine major rock-cut subterranean churches here, all under monastic or priestly care and available for visits. The Christian faith of course is the Orthodox Ethiopian branch, akin to the Coptic, and has been the religion of the country since the fourth century.

These fantastic structures are cut from the living rock, their tops level with the hills, and surrounded by deep rock-cut trenches to free them, and for passage and access. They are connected by long tunnels in the rock, deep dark passages with crude stairs. The rock cuttings, tunnels, and ditches are sometimes 100 feet down from the surface.

A major campaign for restoration is in progress, involving hundreds of labourers under the expert direction of two Italian superintendents. The cement for repairs is made of broken-up and pulverized local stone, so it will be the same colour as the original, rather red. Some of the churches have developed bad cracks. The stone "roofs" of some have weathered badly, scaling, so that water tends to seep through. But a new waterproofing is being applied that will render the roofs impermeable.

At Gondar the palaces are clustered in a walled compound in the centre of the city; a number of beautiful eighteenth century country residences and churches are in the nearby countryside. One of these suburban areas is Kusquam, where one sees the ruins of a handsome eighteenth century country palace of Queen Mentuab.

MUCH of the principal reception room remains—red stone dressed trim around the three arched doorways, lions and crosses in relief on the facade, remains of several stories and many adjacent buildings, with corner circular towers, for little private rooms, not stairs. Stairs were always in a rectangular stair-tower. There are exposed wooden floor beams inside and frequent balcony beams outside. This is sophisticated architecture, done by and for the Ethiopian rulers who were enlightened patrons of the art of architecture.

In town, the Gondar palaces are empty today, and the visitor is free to wander through the deserted halls, climb to the roofs of some, and recreate in his imagination the turbulent life and excitement of three hundred years ago. The crenellated wall of the compound has several gates, and remains of 20 or so buildings, several of which have been restored.

The principal palace is seventeenth century, three stories and towers, with provision for roof-living. A nearby palace (of Yasu the Great, 1682-1706), is very like the country palace at Kusquam. Several other luxurious buildings are scattered through the compound, including an elaborately decorated pavilion of Queen Mentuab, with windows having a series of receding lintels and enframements. One wing is a miniature version,

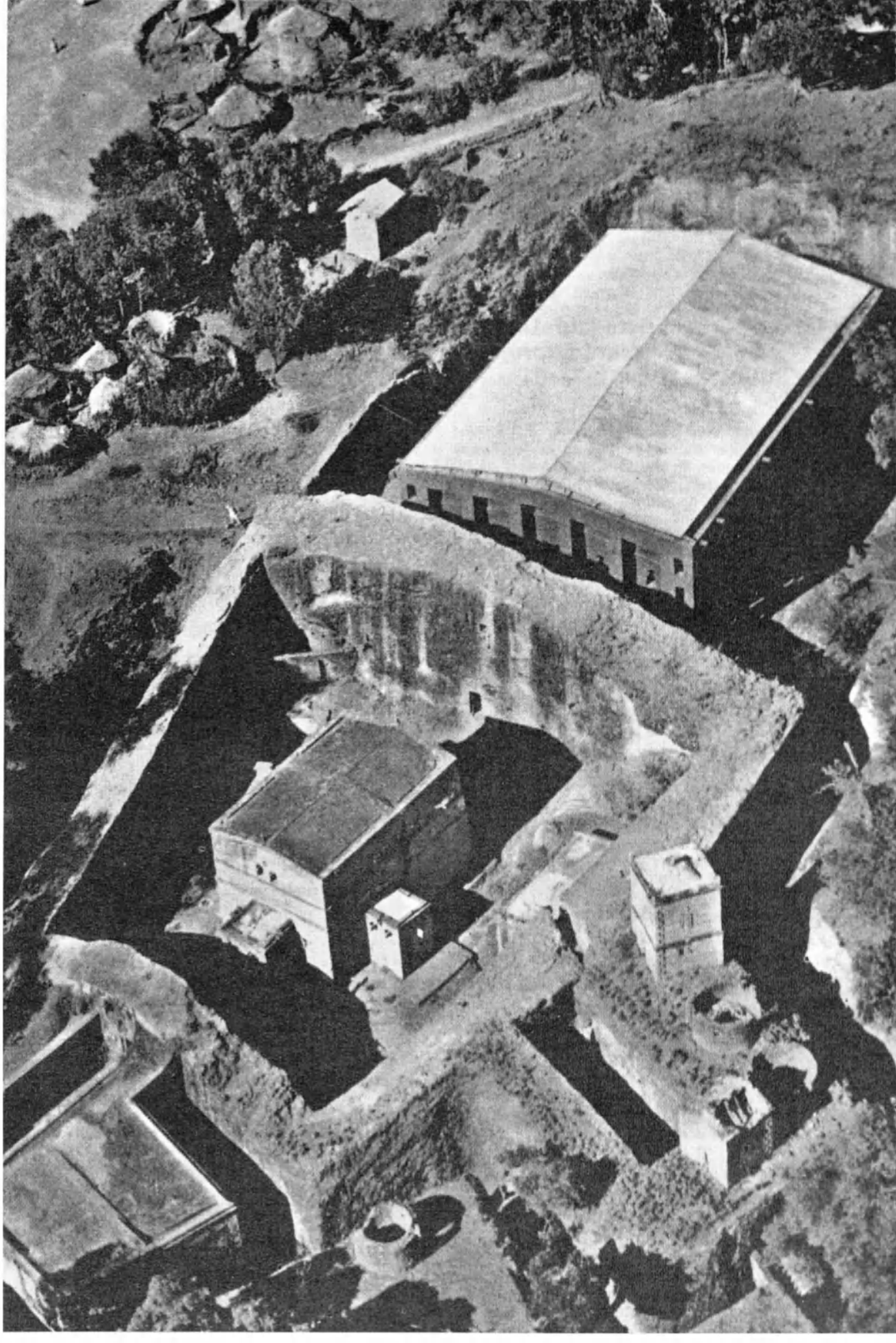


Photo from "Lalibela, Phase I" - International Fund for Monuments Inc.

Air view of a group of five monuments at Lalibela. They are connected by trenches and tunnels which are pockmarked with small caves that must have once been used as cells for monks and rooms for pilgrims. Numerous frescoes, bas-reliefs and paintings adorn the interiors. The largest building (top of photo) is the Biet Medani Alem. Unesco has just completed a mission to Ethiopia to study the country's antiquities and their preservation. At Lalibela, the restoration of the monuments, isolated in rocky hills at an altitude of 8,600 feet, is being carried out jointly by the Ethiopian Government and the International Fund for Monuments Inc.

basically, of the Gallery of Mirrors at Versailles! It was built by King Bakaffa, 1719-1730.

Far earlier than these palaces, and indeed long ante-dating the second-century Axumite remains, are the discoveries of early man, coming to light in the Awash River Valley and farther south in the Omo area. Hundreds of sites are yielding stone tools and other evidences of primitive habitation. A four-nation expedition earlier this year, composed of Ethiopian, Kenyan, French, and American scientists, has shown that primitive man and homonids probably arose in this rich section of Africa.

The Ethiopian range of antiquities is indeed great. A recent Unesco study, released last June (1), had for its purpose the unification of all branches of research concerning the past, so that the country's excavation programmes (by both Ethiopian and foreign archaelogists) can be correlated with an expanding museum development. Both of these are to be co-ordinated with an expanding programme of archaelogical studies at the Haile Selassie I University.

Two learned journals published in Ethiopia, *Annales d'Ethiopie* and *Cahiers de l'Institut Ethiopien d'Archéologie*, share with the scholarly world the secrets of Ethiopia's incredibly magnificent past. This is now also becoming more and more accessible because of the country's tourist facilities that are so ably developed by the Ethiopian Tourist Organization.

(1) "Recommendations for the Organization of the Ethiopian Antiquities Administration" by R.H. Howland.

From the Unesco Newsroom...

Tourists aid Unesco literacy projects

Hotels, travel agencies and guides in Lyon, France, have been selling vouchers worth one franc (20 U.S. cents) to tourists, thus enabling them to make what the Lyon Tourist Office calls a "mini-participation in the campaign launched by Unesco for literacy training in the developing countries." Money raised will buy paper, ink and printing materials for producing farming instruction booklets and mimeographed newspapers destined for rural communities in the developing countries.

Announcement to our readers

Repeated rises in production and distribution costs have made unavoidable an increase in the "Unesco Courier" subscription rates. The new rates, applicable as of January 1, 1968, will be announced in our next issue. Subscriptions and renewals transmitted to Unesco before December 31, 1967 (date of postmark) will be accepted at the old rates.

Biography of Marie Curie in paperback editions

Following our publication last month of the story of the life of Marie Curie based on "Madame Curie", the biography written by her daughter Eve Curie, we have received numerous letters from readers regarding the availability of paperback editions of the book. Paperback versions have been published by Houghton Mifflin Company, Inc., 110 Tremont Street, Boston, Massachusetts; Longmans, Green, Ltd., Pinnacles, Harlow, Essex, U.K., and Pocket Books, a division of Simon and Schuster, Inc., 630 Fifth Avenue, New York, N.Y. 10020. The hardback edition of "Madame Curie" is available from Doubleday and Company, Inc., 277 Park Avenue, New York, N.Y. 10017.

Canadian paper for African adult education

Canada has provided 160 tons of newsprint for adult education in East Africa. It is being used to produce books and other reading material for literacy projects. Textbooks made from the newsprint are already in use in Kenya where a literacy campaign for the Masai people has been launched.

Cannons and steambaths welcome young tourists

A new international youth centre was opened recently by the "Sputnik" Soviet Tourist Office in the picturesque setting of an old Russian fortress at Rostov-Yaroslavski, on the banks of Lake Nero, north-east of Moscow. New arrivals are welcomed with a salvo from the ancient brass cannons and receive traditional Russian hospitality during their ten-to-twelve day stay. Guests are not deprived of modern comforts: those who find the rigours of the old Russian steambath in the presbytery washroom too much for them can take a shower.

U.N. training for African air staff

An East African School of Aviation is to be developed in Nairobi, Kenya, under an agreement between the U.N. Development Programme and the governments of Kenya, Uganda and Tanzania. The project is being supervised by the International Civil Aviation Organization.

BOOKSHELF

UNESCO BOOKS

■ **New Trends in Mathematics Teaching**
Prepared in collaboration with the International Commission of Mathematical Instruction, 438 pp., 1967 ($6.00; 30/-stg.).

■ **Programmed instruction: an international directory**
Compiled under the direction of Seth Spaulding.
The International Education Clearinghouse, University of Pittsburgh, Unesco, Paris (Bilingual: English-French), 1967 ($2.00; 10/-stg.).

■ **Radio and Television in the Service of Education and Development in Asia**
(Reports and Papers on Mass Communication, No 49) 1967 ($1.00; 5/-stg.).

UNESCO'S TRANSLATIONS SERIES

U.S.S.R.

■ **The Balavariani (Barlaam and Josaphat) A Buddhist tale from the Christian East**
Translated from the Old Georgian by David Marshall Lang.
Introduction by Ilya V. Abuladze.
George Allen and Unwin Ltd., London, 1966 (30/-stg.).

Rumania

■ **The Uprising**
A novel by Liviu Rebreanu.
Translated by P. Grandjean and S. Hartauer.
Peter Owen, London, 1964 (35/-stg.).

★

■ **Water in the Service of Man**
By H.R. Vallentine.
Penguin Books, U.K., 1967 (Pelican paperback: 6/-stg.).

■ **The Foundations of our Society**
By Margaret Lusty.
Oxford University Press, London, 1966 (hardback: 30/-stg; paperback: 17/6).

Unesco publishes Apartheid Report

Unesco has just published its Report on the effects of Apartheid on Education, Culture, Science and Information in South Africa (1). Prepared by Unesco at the request of the United Nations Special Committee on the Policies of Apartheid in South Africa, the report terms the situation in South Africa "alarming" and describes in detail how discrimination in the areas studied contributes to maintain an ideology which it says is "unnacceptable to the world of today". (In its March 1967 issue on Apartheid, the "Unesco Courier" published advance excerpts from the report.) Publication in book form in English and French versions is timed to coincide with the submission of the report to the present session of the U.N. General Assembly. Unesco drew up the report with the assistance of Folke Schmidt, of the University of Stockholm (chief consultant), and with the collaboration of J.P. Clark, Nigerian poet and playwright, of the University of Lagos, Prof. P. Sherlock, Vice-Chancellor of the University of the West Indies and Prof. F. Terrou, of the Institut Français de Press, Paris. Its stated object is "to confront the policies and practices of the Government of South Africa in the fields of education, science, culture and information with a number of international norms of conduct to which Unesco is legally and morally dedicated".

(1) "APARTHEID, its Effects on Education, Culture, Science and Information", 224 pp., ($1.50; 8/- stg.; 5.50 F.). Order from any bookseller, or direct from a Unesco national distributor (see page 43).

Flashes...

■ *Motor cars are multiplying so rapidly in Western Europe (present population 320 million persons) that by 1990 that it will have an estimated 180 million vehicules—three times as many as now.*

■ *A recent World Health Organization survey covering 23 industrial countries shows that accidents—principally traffic accidents—are the most common cause of death in the ages up to 45 years.*

■ *This summer, 100,000 students from Soviet universities and technical colleges have spent their holidays working on building and development projects, including homes, farms, railways, clubs and schools.*

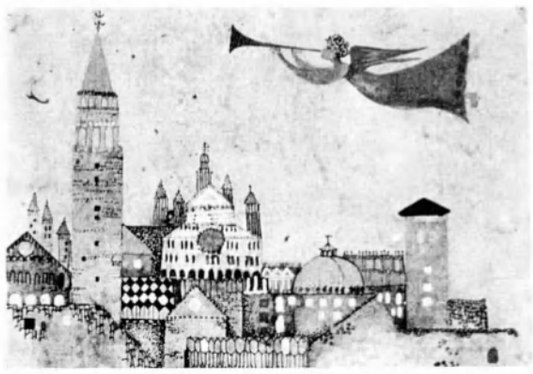
■ *Nordic countries—Denmark, Finland, Iceland, Sweden and Norway—are working jointly to raise $200,000 to help support the Unesco literacy campaign in Tanzania.*

Imp. GEORGES LANG, PARIS. IMPRIMÉ EN FRANCE

UNICEF GREETING CARDS

UNICEF Greeting Cards, whose designs are contributed by internationally-known artists, are sold for the benefit of the United Nations Children's Fund. They help to bring food, medicine and education to needy children in some 120 countries. Over $3 million was raised by the record 50 million UNICEF cards sold last year. A box of ten cards sold means a week's supply of milk for 50 children. Sixteen new cards available this year by artists from Austria, Canada, Finland, France, India, Norway, Spain, U.K., U.S.A. A UNICEF 1968 Engagement Calendar with 54 full-colour illustrations is also available in English-French and English-Spanish versions (15/-; $2.00; 10 F).

Two UNICEF Greeting Card designs for 1967-68—"Ride my little one" by the Indian artist Bhagwan Kapoor (left), and "Peace on Earth" by Ossi Czinner of Austria.



UNICEF cards come in boxes of ten: price 7/6 (U.K.); $1.25 (Canada); 8 F (France). Large format card (Oskar Kokoschka design) 15/-; $2.50; 12 F. For orders write: U.K. Cttee for UNICEF, New Gallery Centre, 123 Regent St., London W.1.; Canadian Cttee for UNICEF, 737 Church Street, Toronto 5, Ont.; Comité Français pour le FISE-UNICEF, 35 Rue Félicien-David, Paris 16e. **Please do not order through Unesco.**

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and order other Unesco publications

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AFGHANISTAN. Panuzaï, Press Department, Royal Afghan Ministry of Education, Kabul. — **AUSTRALIA.** Longmans of Australia Pty Ltd., Railway Crescent, Croydon, Victoria; sub-agent United Nations Association of Australia, Victorian Division, 4th Floor, Askew House, 364 Lonsdale St., Melbourne C. I. (Victoria); for the Unesco Courier only : Dominie Pty Ltd, 463 Pittwater Road, Brookvale (N.S.W.) ($A 2.25). — **AUSTRIA.** Verlag Georg Fromme & Ce., Spengergasse 39, Vienna V (Sch. 70.-). — **BELGIUM.** All publications: Editions "Labor", 342, rue Royale, Brussels, 3. NV Standaard-Wetenschappelijke Uitgeverij Belgiëlei 147, Antwerp. I. For The Unesco Courier (140 FB) and art slides (488 FB) only : Louis De Lannoy, 112, rue du Trône, Brussels 5. CCP 3380.00. — **CANADA.** Queen's Printer, Ottawa, Ont. ($ 3.00). — **CEYLON.** Lake House Bookshop, Sir Chittampalan Gardiner Mawata, P.O.B. 244, Colombo, 2 (Rs. 7). — **CHINA.** World Book Co. 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NEW SKYLINE IN MOSCOW

This 30-story building in the shape of an open book typifies the new architecture transforming the Moscow skyline. The Soviet capital's latest and tallest building, it is the headquarters of the Council for Mutual Economic Assistance. Moscow's housing facilities more than tripled in the past 30 years and a further 650,000 apartments will be added before 1970 (see page 22).